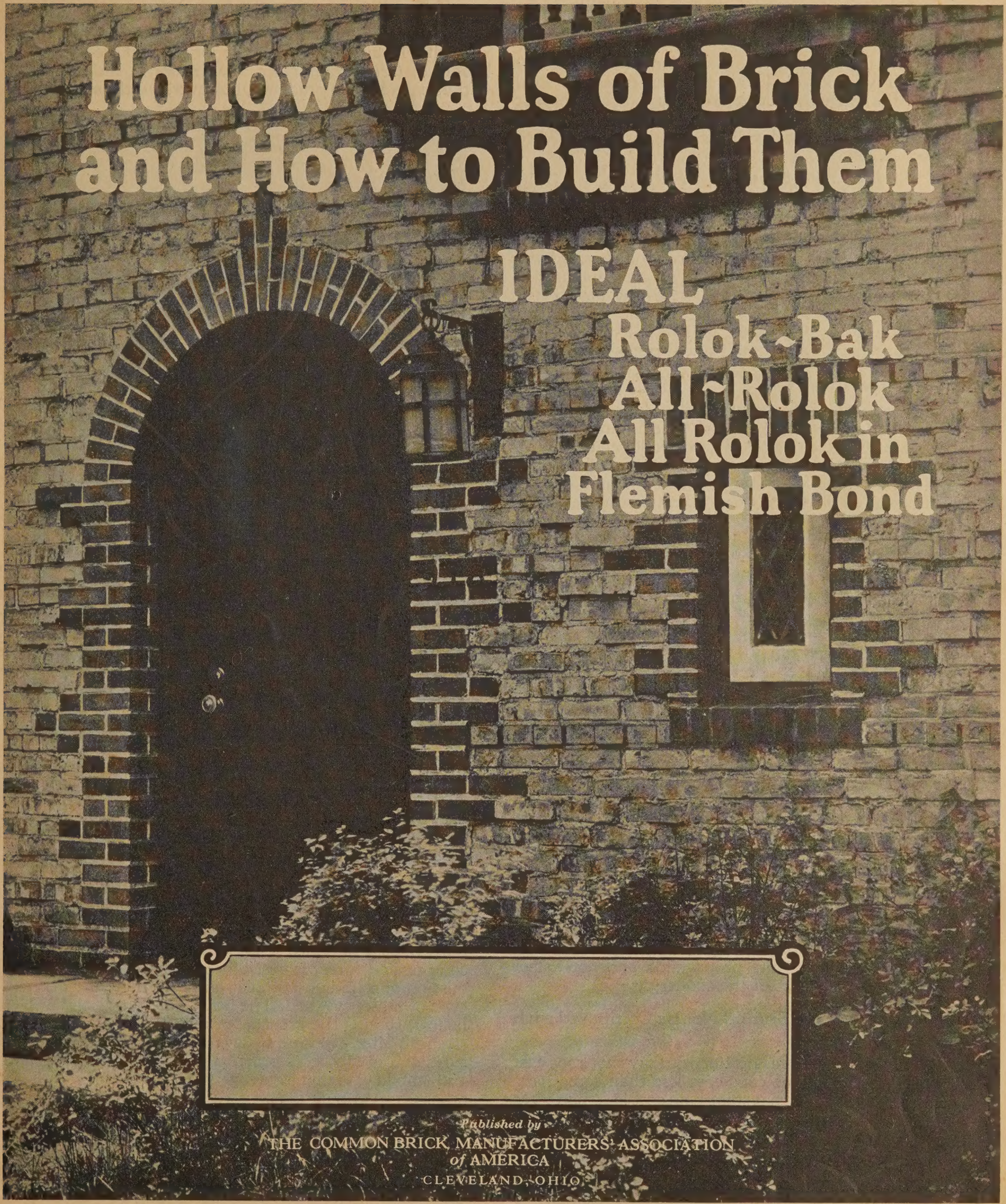
Publication No. 11

Hollow Walls of Brick and How to Build Them

IDEAL
Rolok-Bak
All-Rolok
All Rolok in Flemish Bond



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HOLLOW WALLS OF BRICK

Ideal Wall—Definition:

1. The Ideal wall is the general name used to describe all types of hollow walls built with standard solid brick—the universal and reliable burned clay product—by placing some or all of the brick on edge. There are three types of Ideal walls, all detailed in this publication, as follows:—

Ideal rolok-bak walls.
Ideal all-rolok walls.
Ideal all-rolok walls in Flemish bond.

2. Only in the all-rolok types does the exterior appearance of the Ideal wall differ from the standard and traditional brickwork with which all are familiar. In the other type—the rolok-bak wall—the face of the wall may be worked out in any bond and joint to suit the builder's taste, and the complete wall has the same appearance as a wall of solid brickwork.

Uses of the Ideal Wall:

3. Ideal walls are recommended for all purposes where walls of hollow units of other materials than brick are permitted under building code regulations or by local custom. These pruposes include basement wall construction, load-bearing exterior and interior walls, isolated piers, and curtain and interior partition walls.

Substitutes for Brick Not Always Cheaper:

4. Inventive genius, always busy, has for many years sought various substitutes or alternates for brick which would "save money" for the builder. Throughout all ages and to the present moment, however, brick and natural stone have remained the basic building materials. To leave something out of the solid units making up the wall is the only way that has been found, thus far, to reduce the cost of masonry. This results in reducing also the strength of the wall, and more particularly greatly reduces its fire resistiveness. Whether or not these hollow substitutes for brick really save money is questionable. Only in certain localities is masonry built of these substitutes lower in cost than the solid brick masonry wall. It is a matter of the relative cost of brick and the substitutes, based upon their comparative cost of manufacture, their accessibility to the market where used and whether or not the building code recognizes the necessity of properly regulating the manufacture and use of the substitutes in the interest of safety. Any general statement to the effect that walls of hollow units cost less than solid brick walls is pure propaganda and not a fact applicable to all parts of the country.

Hollow Unit Walls Should Not Be Compared with Solid Walls:

5. It would be just as pertinent to say that caps cost less than hats. Some caps cost less than some hats, but it is equally true that some hats cost less than some caps.

6. A Mexican dollar has the same general size, and shape, and weight as an American dollar, but there is a vast difference in value. So it is with different types of materials of construction.

7. All building units in general use today have some merit. Nearly all are suitable for use and are serviceable *in their proper place*. No modern building unit that has yet been produced, however, has the strength,

Figure 1. Detail of a charming cottage near Bridgewater, England; date of construction about 1803. All-rolok wall in Flemish bond.

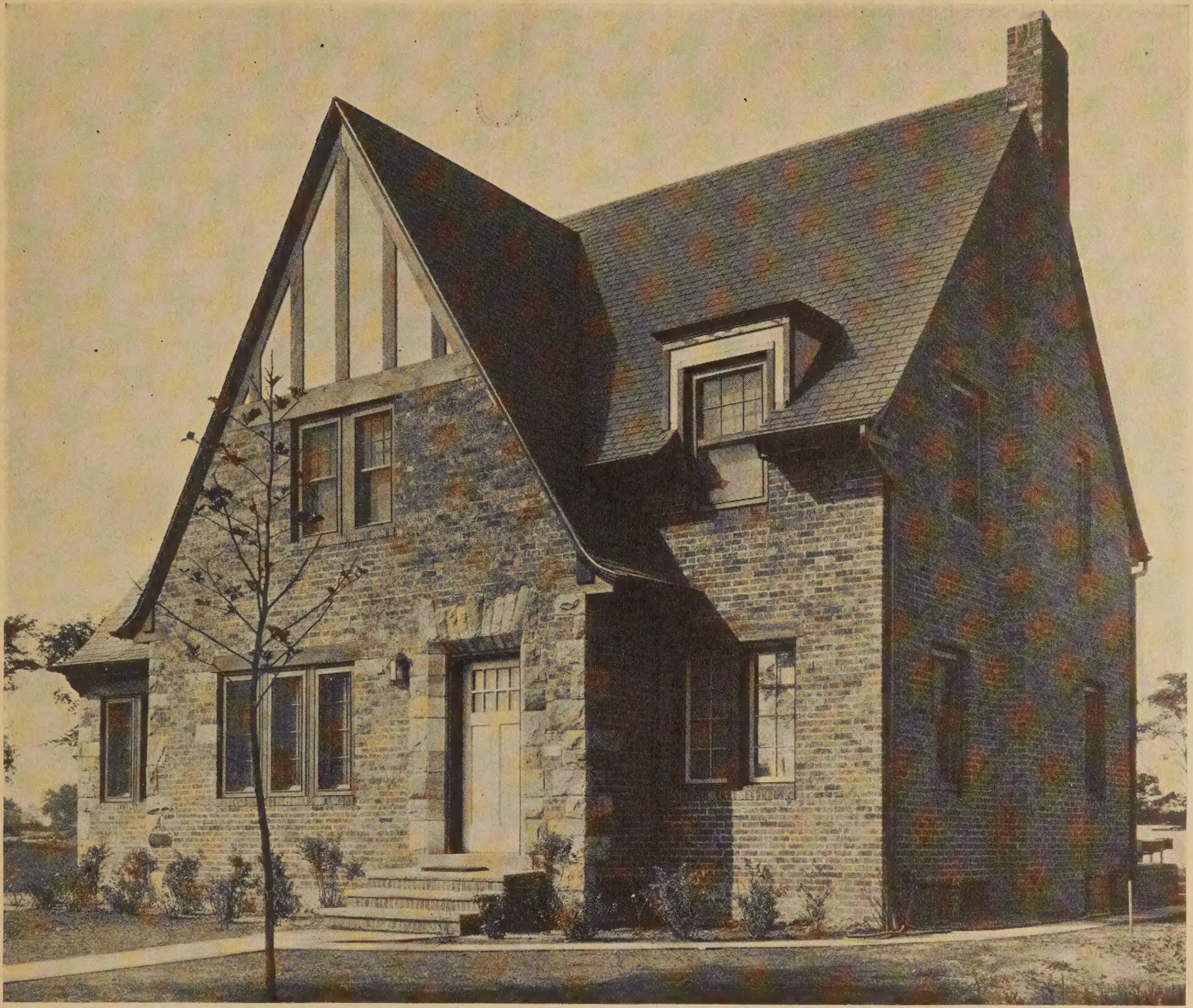
fire resistiveness, and other advantages and merits of brick, and in fact responsible concerns do not promote such units as "just as good" as brick.

Ideal Wall—Highest Grade Hollow Wall:

8. Tests made by authoritative laboratories show that the solid wall of standard brick—the incomparable burned clay product—develops greater strength in compression, greater resistance to fire, lower transmission of sound and of heat and cold than any other type of masonry wall. The brick wall, both solid and hollow, retains the greatest proportion of its original strength after exposure to severe fire at high temperatures and in fact loses practically none of its strength and stability, giving a salvage value far above that of other types of building construction. Brick walls can be safely used again after long exposure to fire.

9. The foregoing statement should not be construed as a recommendation that walls specifically constructed as fire walls should be of Ideal construction. The object of a fire wall is primarily that of preventing the

"WITHE"—Definition. For want of a better descriptive term, the word "withe," used in connection with the Ideal wall, denotes each continuous vertical solid bearing section or thickness of brickwork, either 2¼" or 3¾" thick, in such walls.



Yeager and Krause, Architects

Figure 2. Rolok-bak wall house at Shaker Heights, Ohio. Basement 12″ all-rolok wall below grade; first and second floor and gable walls, 8″ rolok-bak walls bonded with Flemish headers every seventh course. (Built in 1924 by builder whose letter appears on page 8).

spread of fire, and while the Ideal wall gives the highest degree of fire protection when compared with other hollow walls, it is not so efficient as the solid wall of brick.

10. "The great value of solid walls in restricting the spread of fire is so well known, argument should be unnecessary to insure their use wherever suitable," says the National Board of Fire Underwriters' Code.

Ideal Walls Grow in Popularity:

11. For certain kinds of structures and under some conditions the solid brick wall possesses an excess of strength and of fire resistance. This fact led to the development of hollow walls of standard solid brick, (known as Ideal walls), which reduce construction costs and at the same time give the remarkable advantages that always go with the use of this ancient and dependable standard building unit.

12. In 1921 promotion of the Ideal wall was begun by the Common Brick Manufacturers' Association of America. Probably no new type of construction has ever grown to popularity in such a short time. Ideal walls, in most of the types detailed in this pamphlet, are in general use throughout the world.

13. Although thought to be new when introduced by this Association, it was found later that examples of this construction existed in nearly every part of the world where brick is used. Walls built in this fashion more than 200 years ago have been located and examined.

14. In the brief period since the promotion of hollow walls of brick began in America, the Ideal wall has been adopted by builders as the most economical type of masonry construction for walls 8″ thick and over. New building codes in many important cities have recognized and provided for Ideal walls and old codes have been changed so that the public can take advantage of this economical type of masonry construction.

15. In many smaller cities where a brick house had not been built for many years, the Ideal wall is the prevailing construction for homes today.

16. The National Building Code Committee appointed by Secretary Herbert Hoover includes Ideal wall in its recommended practice report. The National Conference of Building Officials of the United States has passed a resolution approving the Ideal wall (Page 22).

Ideal Walls Always Economical:

17. The only advantage that applies always to any type of hollow wall as compared to a solid brick wall is that the hollow wall is lighter than the solid. The question of the economy of *hollow unit* walls is a local one, inasmuch as they actually cost more than solid brick construction in many localities. But with the Ideal wall the economy advantage applies everywhere because it is built of the same material as the solid wall but requiring a smaller quantity. The saving varies according to the type of Ideal wall decided upon.

The Greater the Solid Thickness, the Greater The Insulation:

18. A talking point or sales argument used for some types of hollow building units is to the effect that they produce a warmer wall than a solid wall. The propaganda which has aimed to establish this fallacy has been so persistent that many have been led to accept it as a credible fact. Even some architects have been unduly influenced by this propaganda, and often some writer on building construction subjects falls into the error of repeating this false statement, believing it to be true.

19. The fact is, true dead air spaces, which alone have high insulating value, must be microscopical in size, and every brick contains a mass of such cells. Large air spaces in a wall are not dead air cells.

20. Tests have been made at various times to show the insulating value of wall materials. These tests have been made under such widely varying conditions, however, that when the figures are compared they are contradictory and inconclusive.

21. Some interesting comparative figures are obtained when testing walls for fire resistance. In all such tests the furnace temperature is controlled to conform as nearly as possible to a "standard time temperature curve" and the rate of increase in the temperature of the unexposed side of each type of wall is therefore the measure of its insulating value. Bureau of Standards figures show that thin shell hollow unit walls 8 inches thick reached the critical temperature of 482° F. on the unexposed side of the wall in 3 hrs. 5 min.; that thick shell hollow unit walls 8 inches thick reached the same temperature in 4 hrs. 10 min.; *and that in ten tests of solid brick walls 8 inches thick not one of the walls attained that temperature on the unexposed side even at the end of the tests, which lasted six hours, the average temperature at the end of the tests being only 287° F.* Even brick walls only 4" thick did not reach the same critical temperature on the unexposed side until 2 hrs. 28 min. (average of two tests) after the start of the tests. Ideal wall figures are given on page 21. The figures are summarized in the following table.

Fire Test Figures Indicating Insulating Value of Various Types of Wall Construction

Type of Wall	Time at which 482° F was reached on unexposed side of wall.
8" hollow unit, thin shells..........	3 hrs. 5 min.
8" hollow unit, thick shells..........	4 hrs. 10 min.
8" Ideal walls (average of 3 tests lasting 6 hrs.)......................	5 hrs. 40 min.
8" solid brick walls................	Not attained at end of 6-hr. tests. Temperature at end of tests averaged 287° F.
Brick walls only 4" thick..........	2 hrs. 28 min.

22. These figures clearly prove that the solid brick wall is the very best insulation against heat and therefore against cold and that the Ideal wall comes next in point of efficiency.

Exterior Masonry Walls Should Generally be Furred or Waterproofed:

23. As a general safe rule, all types of exterior masonry walls, of whatever material constructed, and whether solid or hollow, should be furred, lathed, and plastered on the inside surface to ensure non-passage of moisture and to guard against condensation. Satisfactory results are also often obtained by waterproofing the inside surface.

24. This Association makes this super-cautious general recommendation to include all-rolok construction in Flemish bond also, even though a multitude of structures have been built in that construction and plastered directly on the brickwork, and in all that number not more than half a dozen cases have been reported where traces of moisture appeared on the inside face of the wall, and that result was found to be due in every instance to carelessness in construction.

25. It is almost impossible under practical conditions for a well burned header to carry moisture along its entire length by capillary attraction. Moisture can, however, be conducted under severe conditions through a continuous mortar joint either of cement or lime mortar.

26. In most types of the Ideal wall there is no continuous mortar joint from front to back of the wall. (Where plaster is to be applied direct such continuous through mortar joints must be avoided in case small sections of the wall are built solid for various purposes).

27. In most types of the Ideal wall there is also an additional safeguard in the fact that a slight steady circulation of air within the cavities dries out any small amount of moisture that might reach the portion of the header in the hollow space.

28. The properly constructed Ideal all-rolok wall in Flemish bond has established an enviable reputation for itself in many sections of the country as a wall which can be confidently relied upon to be thoroughly dry when plastered directly on the brick.

29. If in any locality it has been found by experience that walls of hollow units do not need to be furred and lathed, then the various types of Ideal walls used under the same condtions and with the same grade of workmanship, can be depended upon with much greater confidence to be dry and furring can be omitted.

Waterproofed Walls in California Climate Need No Furring:

30. Highly successful results have been accomplished in California and other parts of the country by waterproofing the inside face of solid walls, or by dipping about half of the length of each header in Ideal walls, in a waterproofing mixture of equal parts of asphaltum and distillate, the waterproofed end of the header being placed toward the inside of the wall. In that climate walls so treated do not need to be furred, and the plastering may be placed directly on the surface of the brickwork. This treatment is quite inexpensive.

Ideal Wall is Light Weight Wall:

31. Where lightness of weight in masonry is considered an advantage, the Ideal wall, when built as an independent wall or when used as a backup for exposed

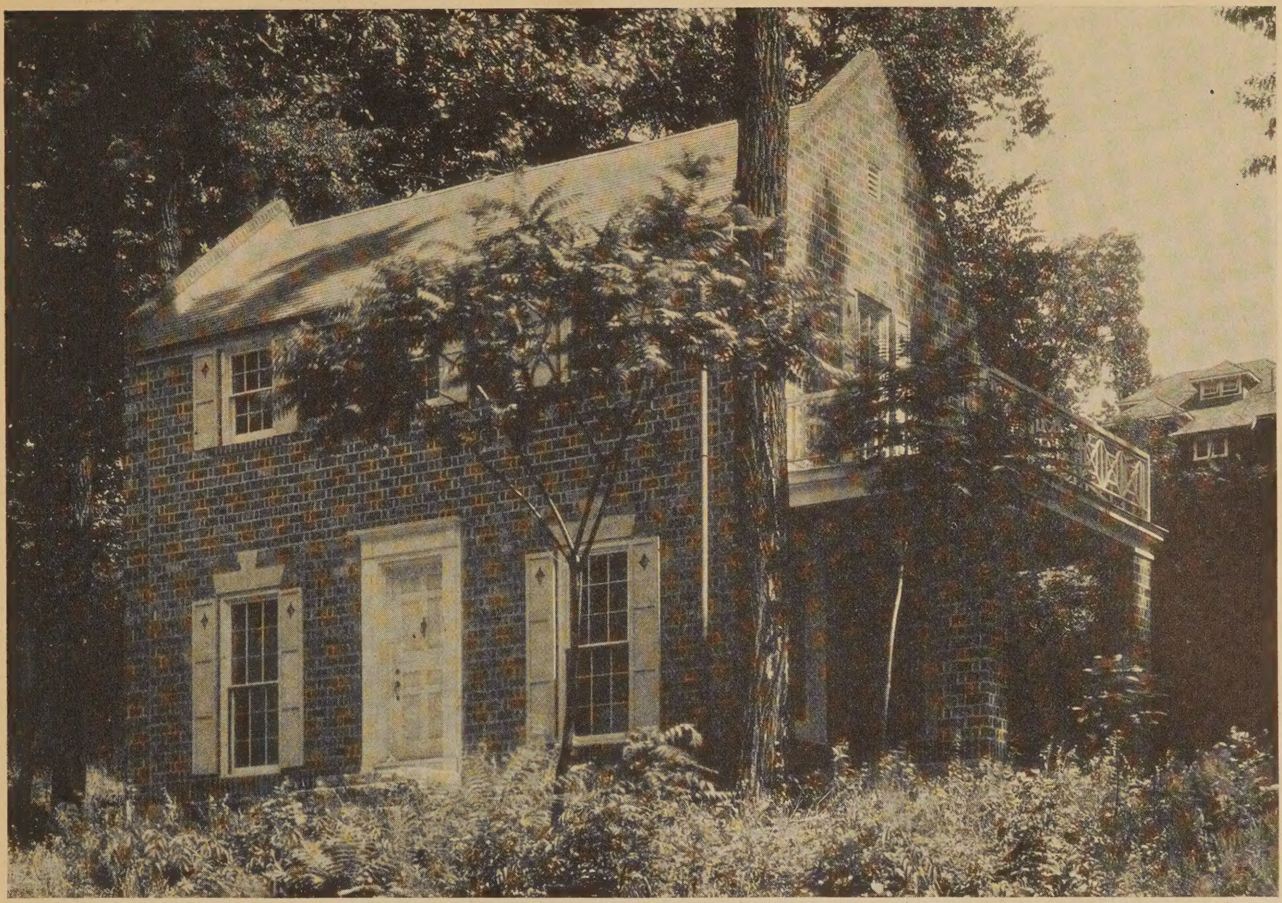


Figure 3 House at Dobbs Ferry, New York. All-rolok wall in Flemish bond. *Theodore Meyer, Architect*

brick, stone, or terra cotta is lighter than the average hollow unit construction. The Ideal wall is especially desirable and economical for curtain or panel walls and for inside partitions in steel or reinforced concrete skeleton buildings on this account. When the Ideal wall is used as back-up construction, the facing material becomes a part of the masonry, making a wall that is thoroughly bonded together.

Ideal Wall Resists Blows and Impact:

32. One of the great advantages of brick in hollow walls is the strength of its sturdy "withes"* and their high resistance to impact or transverse stress. The thickness of a standard brick, 2¼″, is the narrowest bearing surface in any part of the wall. In garages, warehouses or other industrial structures where by accident there may be occasional impact against the wall, the Ideal wall will be found more suitable than any other type of hollow wall because such impact is resisted by the inertia of the considerable mass of solid material in the withes of the wall, which do not break or shatter. (See also par. 11 item *d*, page 22).

Light Burned Brick for Interiors and Backing:

33. Salmon or light burned brick are serviceable in the back withes of Ideal wall, when they are not exposed to the weather. This permits the use of the lowest priced brick obtainable and thereby reduces cost. Walls of salmon brick have more than enough strength for ordinary purposes.

Ideal Walls Have Great Sound Resistance:

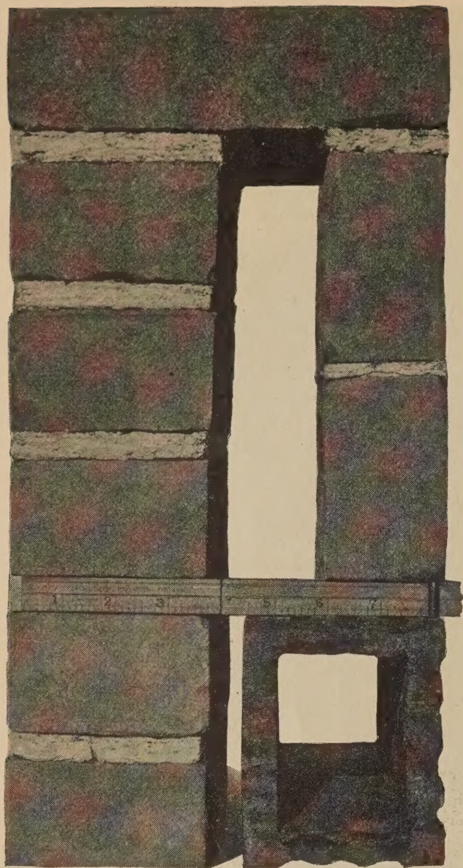
34. Soundproofness (not an important factor in ordinary wall construction) according to scientific tests increases in direct ratio with the increase of the solid mass of the material in the wall. Consequently the hollow wall of solid brick has great sound resistiveness.

Solid Sections Constructed Without Change of Material:

35. Wherever pilasters or buttresses or short sections of the wall are designed to carry heavy concentrated loads, these can without change of material be constructed of solid brickwork. Small sections of solid wall can also be built for a variety of purposes, as for instance chimneys, fireplaces, bearings for heavy girders, skewbacks for arches, the secure anchoring of metal straps, guards, shafting, etc. With the Ideal wall there is no waste or loss of time in building such solid sections, as the mason is working always with one standard masonry unit only—brick. No special material has to be taken on the scaffold.

36. No problem is involved in building around window and door openings or at corners or in the working out of any detail in construction with Ideal walls. Brick units are comparatively small and this makes brick construction "flexible." The normal quantity of "bats" or broken brick are used in the Ideal wall so that no material is wasted. Even small pieces of brick can be built into the wall.

**Withe. Each continuous solid bearing section or thickness of brickwork, either 2¼ in. or 3¾ in. thick, in Ideal walls.*



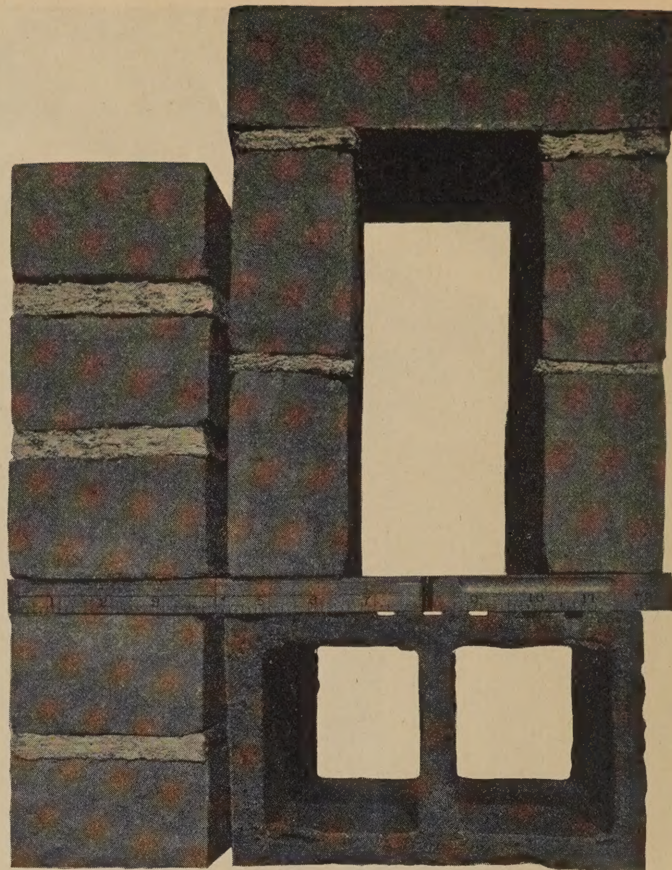


Figure 4. The illustrations show, below the rules, cross section views of 8″ and 12″ walls constructed with brick facing and typical hollow back-up units; above the rules, 8″ and 12″ rolok-bak walls. Total net thickness of solid bearing material in the two ⅝″ shells of the hollow unit on the left—1¼″; in the three shells in the right hand illustration—1⅞″. Total net thickness of brick on edge withe forming the backing of the rolok-bak wall, left hand illustration (one withe) 2¼″; right hand illustration (two withes) 4½″. These illustrations are shown for the information of building code officials in cities where hollow unit walls are now permitted, as proof of the sturdiness, stability, and great strength of the Ideal wall and as compelling reasons why the Ideal wall should be permitted under the same codes.

No Special Brick Required—Standard Brick Throughout:

37. It should be emphasized that the brick used in all types of Ideal wall construction is ordinary brick; the reliable burned clay product that may be obtained at any brickyard, and that no special shapes or sizes are required. In other words, the Ideal wall is not a wall of hollow brick, but is a hollow wall of solid brick.

Factors Affecting the Strength of the Ideal Wall:

38. It is of great importance that each withe of the Ideal wall has a sturdy solid thickness of at least 2¼″, and this is of special advantage on the side of the wall which supports joists, because a joist which deflects even slightly under load obviously transmits the weight to the edge of the masonry upon which it rests.

39. In laying the Ideal wall, the brick in every withe will always be in vertical alignment and the wall is always thoroughly capable of taking its full load.

40. The Ideal wall is bonded or tied together in the direction of its thickness with the same sturdy solid brick units that form its withes.

Investigate Lower Cost and Other Claims of Substitutes:

41. If anybody attempts to compare hollow walls with solid walls, either as to cost or as to number of units per square foot, check up carefully the merits of the Ideal wall with the authentic record and performance of all other types of hollow unit walls. Use your pencil and estimate your local costs from the data in the following pages and find that by the use of brick—the good old unit you always have used—you can produce hollow walls that are better in every particular, and at lower cost.

ADVANTAGES OF IDEAL WALL SUMMARIZED

Lowest cost masonry wall possible to build for construction 8″ thick and over.

Strongest hollow masonry wall.

Most highly fire resistive hollow wall—not damaged by long exposure to high temperatures or water used in extinguishing fires.

The dryest hollow masonry wall.

Contains thickest withes and has large percentage of solids to voids.

Lighter in weight than the average hollow unit wall of brick substitutes .

Built of standard brick—no special sizes or shapes.

Bonds perfectly with any facing material.

Recognized by National Building Code Committee and National Building Officials' Conference.

The Ideal wall means satisfied bricklayers.

DESCRIPTION AND CONSTRUCTION DATA

THE ROLOK-BAK WALL

General Description:

1. The rolok-bak wall is a general utility wall, and may be employed not only for exposed walls but for unexposed walls and for basement construction. It forms a perfect base for stucco where that finish is particularly desired, and for plaster in interior walls.

2. The exterior four-inch thickness is laid with brick placed flat and the backing is laid of brick on edge. On the exterior, therefore, the brickwork has the usual appearance of brickwork laid in the traditional way and may be faced in any bond. The wall may be 8″ thick or in multiples of additional 4″ thicknesses.

3. In the 12″ thickness, there are two types of the rolok-bak wall—the *standard* (page 10) and the *heavy duty* (page 11).

4. In the standard rolok-bak wall, the flat header course is arranged in basket weave bond so that it ties the whole wall together as shown clearly in the illustrations. This allows of the greatest saving in cost both in labor and material. A flat header course is laid with less labor than a solid header course on edge and the wall requires fewer brick and less mortar per square foot.

5. The standard rolok-bak wall is designed for bearing walls of buildings in the multiple residential and other classes where a 12″ thickness of wall is required and floor loads are moderate, such as apartment buildings, hospitals, clubs, office occupancies, etc.

6. The heavy duty rolok-bak wall is designed for situations where heavy floor loads are to be carried.

7. The heavy duty wall is constructed by building the withes of the backing of three courses of stretchers on edge, the fourth course being a continuous course of headers on edge. On this course is laid a continuous course of flat headers, to tie the facing to the backing, with a flat stretcher fill behind it.

Appearance:

8. The Ideal rolok-bak wall has exactly the same exterior appearance as ordinary brickwork.

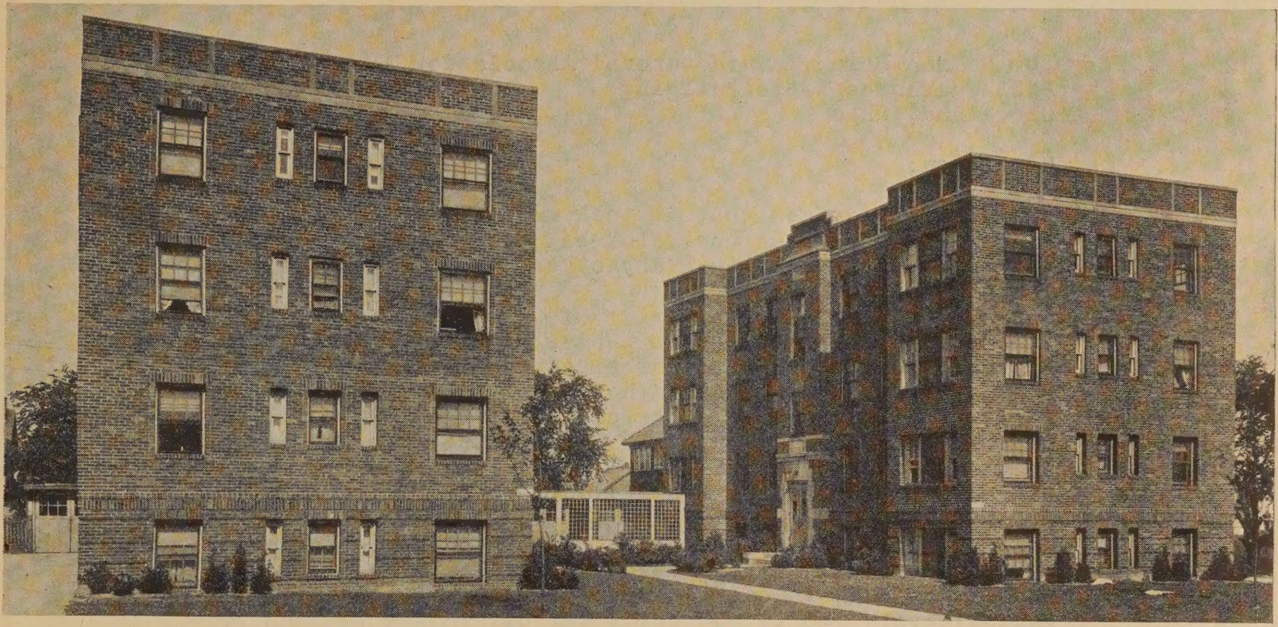


Figure 5. Rolok-bak wall apartment buildings at Cleveland, Ohio. Basement wall below grade is 12″ all-rolok wall in Flemish bond. Basement above grade, and first floor walls are 12″ rolok-bak walls. Second and third floor walls are 8″ rolok-bak walls. (Constructed in 1923 by builder whose letter appears on page 8).

9. While the illustrations show this type of construction in common bond, any of the other bonds may be used instead. Even with the solid brick wall, all headers not necessary for strength are bats not extending through into the backing, when the more

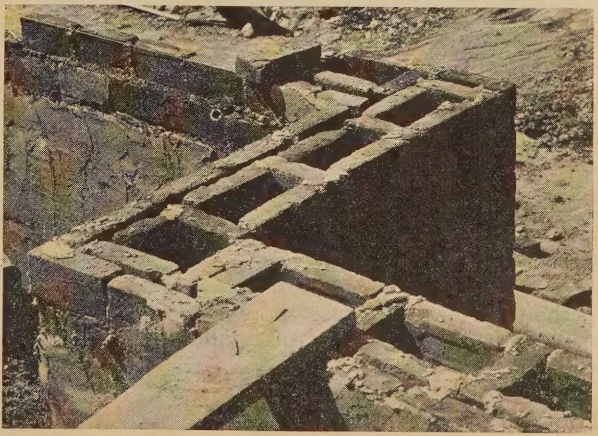
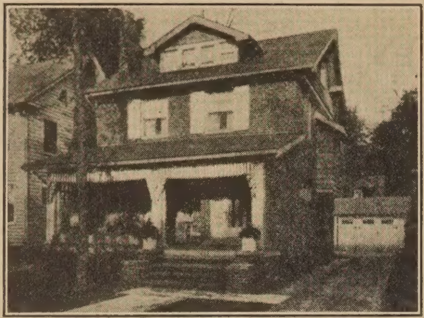


Figure 6. Foundation wall below grade of apartment buildings shown in Fig. 5. 12″ all-rolok wall in Flemish bond.



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Cleveland, Ohio

August 15, 1925

The Common Brick Manufacturers' Association
2121 Guarantee Title Building
Cleveland, Ohio

Gentlemen:

I will confess that it took me some little time to convince myself that the rolok-bak wall is not only better but cheaper to build than any other type of 8 or 12-inch masonry.

For the past two years I have used exclusively rolok-bak wall in all my work in residences and apartments. For many years prior I had used hollow units wherever the code permitted it, and I made the change to rolok-bak wall principally because I saved money by doing so, and, secondly, because I find the bricklayers would rather handle brick than any other kind of masonry unit.

You will be interested to know that over a period of two years my bricklayers have averaged 1200 to 1300 brick per day on edge in backing up a 12-inch Ideal wall, and approximately 700 to 800 brick per day in the backing up of the 8-inch Ideal wall.

I have also found economy in using only one kind of back-up material, and this is especially true in the saving of time in laying the wall around window and door openings.

Should I be able to furnish you with any further information pertaining to these types of wall, I will gladly do so.

Yours very truly,

Andrew Pentland

President and General Manager

elaborate bonds such as Flemish, English, English cross, etc., are used; because the bricklayer can save much time by building the outside 4″ thickness "header high," afterward backing up. The same method of forming these more elaborate bonds by using bats is followed when building the rolok-bak wall.

The Flat Header Course:

10. Every seventh course of brick laid flat is a header course, to bond the facing to the backing.

11. Most building codes require this course to consist entirely of headers, a "continuous header course." Other codes permit this course to consist of headers and stretchers placed alternately—a "Flemish header course."

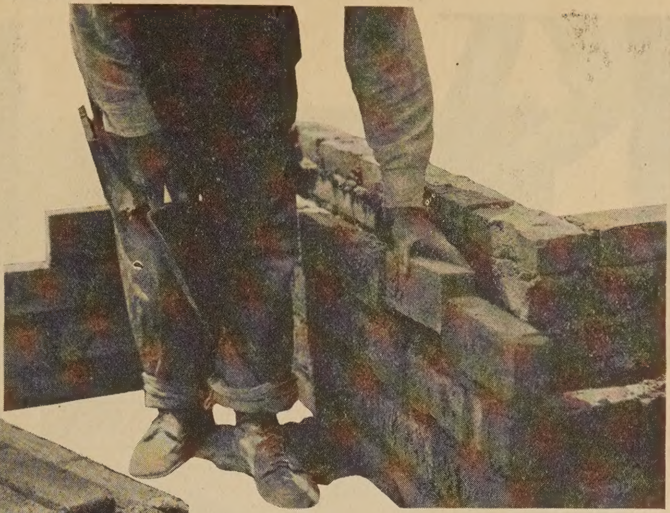
12. The continuous header course is shown in these illustrations, except in the standard 12″ wall.

13. The header course tying the two withes of the backing together in the 12″ heavy duty wall is shown as a continuous header course on edge as this provides maximum strength.

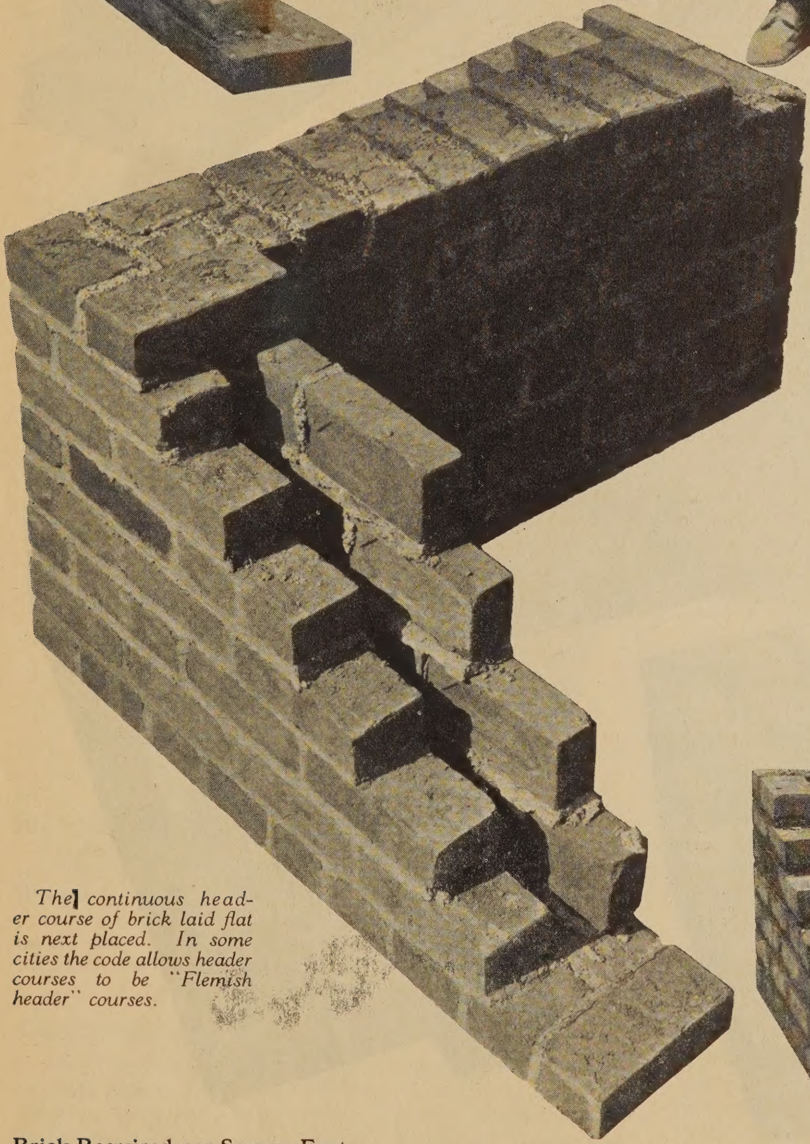
CONSTRUCTION OF THE 8" ROLOK-BAK WALL

(See paragraphs 14 to 18)

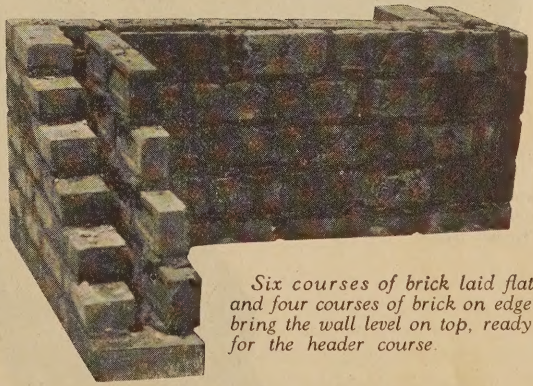
Six courses of the outside 4" withe are first laid.



Backing up with the inside "withe" of brick on edge. Note how easy and simple it is to build this sturdiest type of back-up construction.



The continuous header course of brick laid flat is next placed. In some cities the code allows header courses to be "Flemish header" courses.



Six courses of brick laid flat and four courses of brick on edge bring the wall level on top, ready for the header course.

Brick Required per Square Foot:

7 exposed brick (for 4" withe and headers), 3½ backing brick (for 2¼" withe). Total 10½ brick.

Weight:

With brick at 4½ lb. each and including mortar, backing weighs about 25 lb. per square foot and facing about 39 lb. per square foot.

Cost of Brick per Square Foot:

Take cost of brick per thousand in dollars, call dollars cents, and divide by 10. Result is cost of each brick in cents. Multiply result by number of brick to the square foot as given in opposite column.

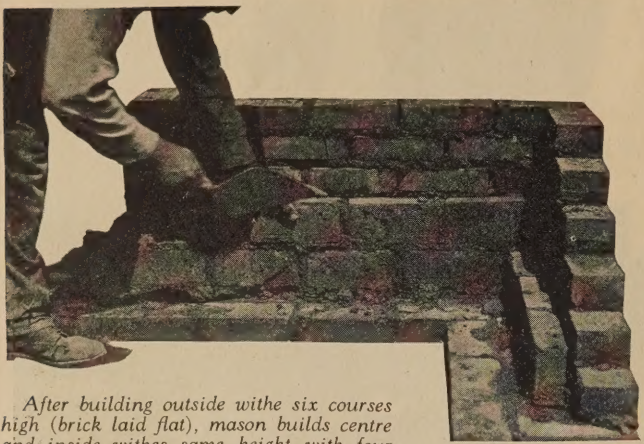
Examples: Brick at \$12 per thousand cost 1.2 cents each; at \$20, 2 cents each. Square foot cost of brick in backing at \$12 per thousand, 3.5x1.2=4½ cents; at \$20 per thousand, 3.5x2=7 cents.

Labor Cost:

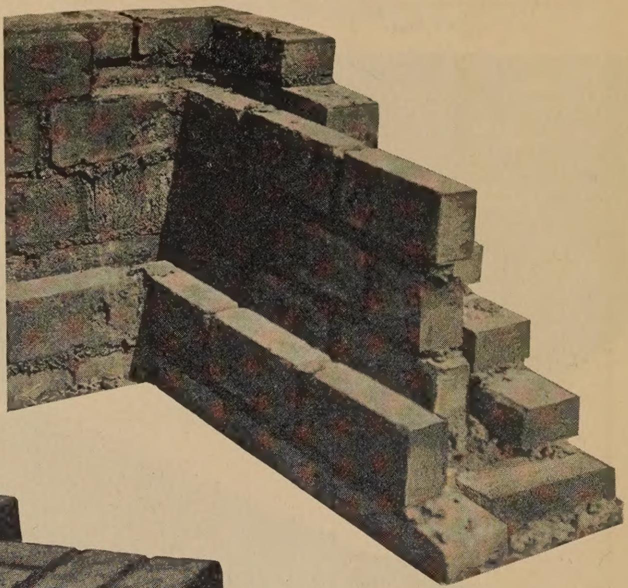
In walls with usual number corners and openings, safely estimate that a mason will lay 85.7 sq. ft. per day in carefully faced work. Laborer's time ⅔ mason's. In rougher work 135.7 sq. ft. per day with laborer's time ¾ mason's.

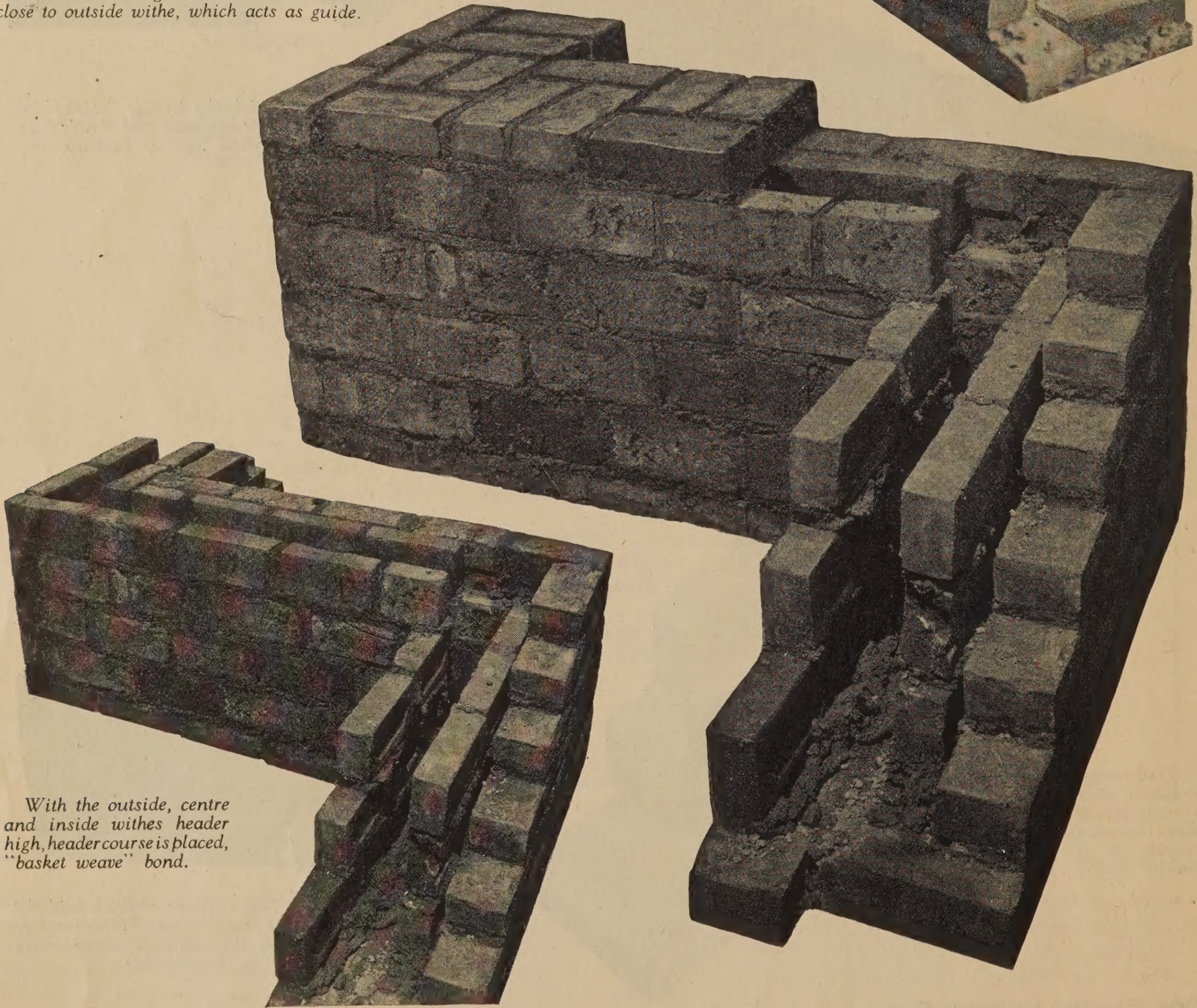
CONSTRUCTION OF THE 12" STANDARD ROLOK-BAK WALL

(See paragraphs 19 to 28)



After building outside withe six courses high (brick laid flat), mason builds centre and inside withes same height with four courses brick on edge. Centre withe is built close to outside withe, which acts as guide.





With the outside, centre and inside withes header high, header course is placed, "basket weave" bond.

Brick Required per Square Foot:

6.6 exposed brick (for 4" withe and headers), 8.4 backing brick (for 2¼" withes.) Total 15 brick.

Weight:

With brick at 4½ lb. each and including mortar, backing weighs about 50 lb. per square foot and facing about 39 lb. per square foot.

Cost of Brick per Square Foot:

Take cost of brick per thousand in dollars, call dollars cents, and divide by 10. Result is cost of each brick in cents. Multiply result by number of brick to the square foot as given in opposite column.

Examples: Brick at $12 per thousand cost 1.2 cents each; at $20, 2 cents each. Square foot cost of brick in backing at $12 per thousand, 8.4x1.2=10 cents; at $20 per thousand, 8.4x2=16.8 cents.

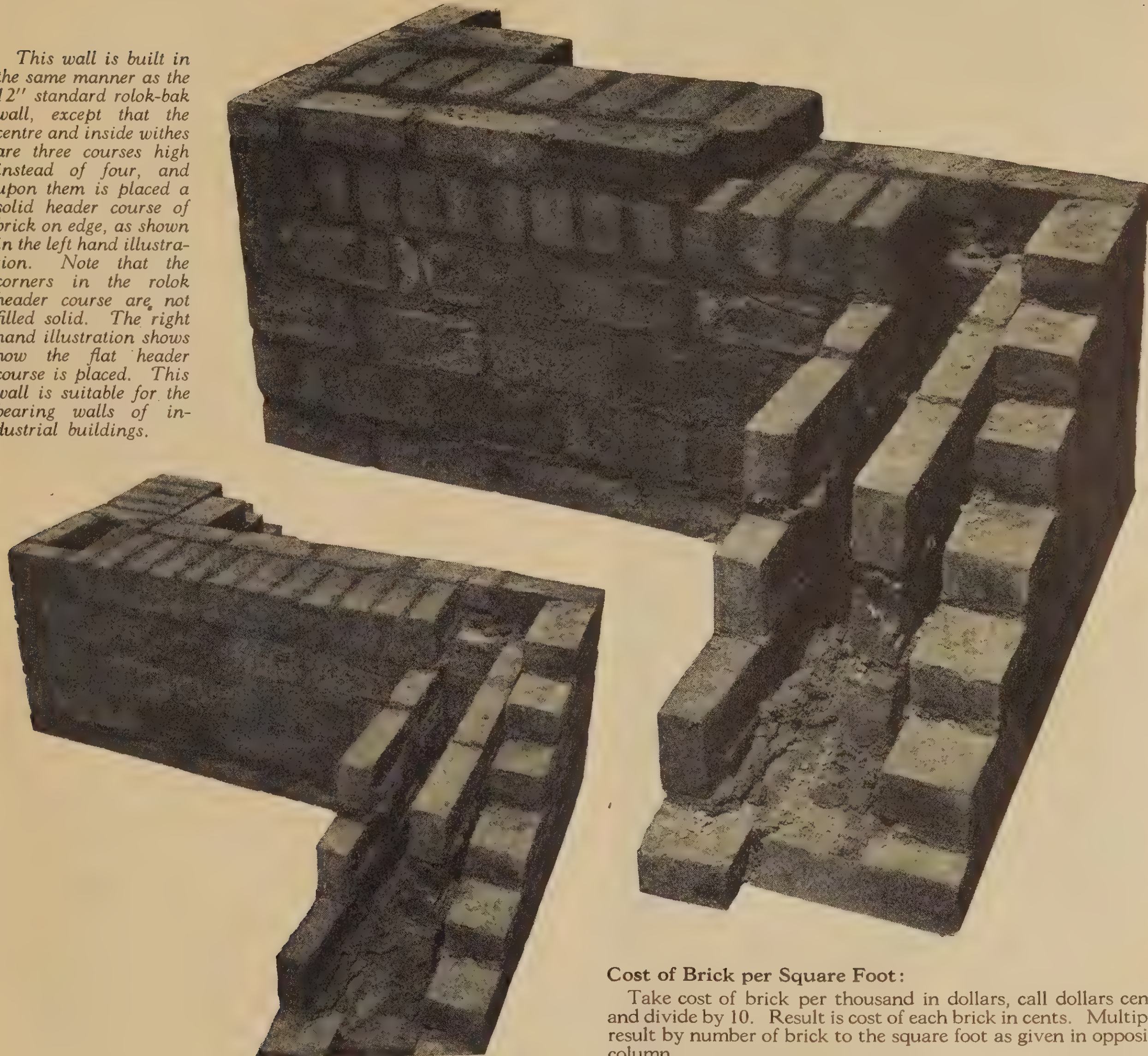
Labor Cost:

In walls with usual number corners and openings, safely estimate that a mason will lay 72.7 sq. ft. per day in carefully faced work. Laborer's time ⅔ mason's. In rougher work 108.3 sq. ft. per day with laborer's time ¾ mason's.

CONSTRUCTION OF THE 12" HEAVY DUTY ROLOK-BAK WALL

(*See paragraphs 29 to 37*)

This wall is built in the same manner as the 12" standard rolok-bak wall, except that the centre and inside withes are three courses high instead of four, and upon them is placed a solid header course of brick on edge, as shown in the left hand illustration. Note that the corners in the rolok header course are not filled solid. The right hand illustration shows how the flat header course is placed. This wall is suitable for the bearing walls of industrial buildings.



Brick Required per Square Foot:

7 exposed brick (for 4" withe and headers), 8.8 backing brick (for 2¼" withe). Total 15.8 brick.

Weight:

With brick at 4½ lb. each and including mortar, backing weighs about 56.5 lb. per square foot and facing about 39 lb. per square foot.

Cost of Brick per Square Foot:

Take cost of brick per thousand in dollars, call dollars cents and divide by 10. Result is cost of each brick in cents. Multiply result by number of brick to the square foot as given in opposite column.

Examples: Brick at $12 per thousand cost 1.2 cents each; at $20, 2 cents each. Square foot cost of brick in backing at $12 per thousand, 8.8x1.2—10.5 cents; at $20 per thousand, 8.8x 1.2=10.5 cents; at $20 per thousand, 8.8x2=17.6 cents.

Labor Cost:

In walls with usual number corners and openings, safely estimate that a mason will lay 68.5 sq. ft. per day in carefully faced work. Laborer's time ⅔ mason's. In rougher work 92.8 sq. ft. per day with laborer's time ¾ mason's.

Constructing the 8" Wall:

14. The bricklayer first lays six flat courses on the outside face of the wall. He then lays four courses on edge to form the inside withe. Six flat courses equal four courses on edge in height. He then places the header course.

Material and Labor Required, 8" Wall:

15. This wall requires 7 exposed brick and 3½ backing brick per square foot.

16. In walls with the average number of openings and corners, the contractor can safely and conservatively estimate that in front and other walls carefully faced, each mason will lay 600 exposed brick backed up with 300 backing brick per day in this wall, or a total of 900 brick per day; and for rougher work in side and rear walls and in unexposed walls each mason will lay 950 exposed brick backed up with 475 backing brick per day, or a total of 1,425 brick per day.

17. This equals 85.7 sq. ft. per day for carefully faced work, and 135.7 sq. ft. per day for rougher work.

18. Laborer's time should be figured at ⅔ of the bricklayer's time for carefully faced work, and ¾ for rough work.

Figure 7. A preliminary private test on an 8″ rolok-bak wall, built of brick with about 5,000 lbs. per square inch crushing strength, laid in 1:1:6 cement-lime mortar. Specimen, about 9 feet high, sustained a total load of 45 tons per foot run or 936 lb. per square inch of gross area of wall when only 30 days old. Photograph taken when load had reached 42.8 tons per foot run or 891 lb. per square inch gross area. This wall is a variation of the wall here recommended. It is built with "Flemish header" bond courses instead of continuous headers, and the latter make an even stronger wall.

Constructing the 12″ Standard Wall:

19. The six flat courses outside are first placed as for the 8″ wall.

20. The centre and inside withes are then built together according to the ordinary practice in the backing of brickwork, each four courses high.

21. The brick for the centre withe are placed against the back of the outside 4″ withe, which thus forms a guide for the centre withe. No mortar is placed in the vertical joint between the outside and the centre withes.

22. Although the pictures show the end joints in the centre withe full of mortar, it is necessary only to see that the bed joints are full, the brick being placed two at a time by the bricklayer—one in each hand—upon the bed of mortar previously spread. The labor necessary for the centre withe is thus very much less than for the inner withe.

23. Then place the flat header course to tie the wall together. It is suggested that this course be backed up as each 8″ length is placed. The headers are laid "basket weave" fashion, one pair of headers being placed at the face of the wall, backed up by a stretcher; then a stretcher is placed at the face of the wall, backed by a pair of headers.

24. It is important to stagger the position of the pairs of exposed headers with respect to their position in the header course immediately below.

Material and Labor Required, 12″ Standard Wall:

25. This wall requires 6.6 exposed brick and 8.4 backing brick per square foot.

26. In walls with the average number of openings and corners, the contractor can safely and conservatively estimate that in front and other walls carefully faced, each mason will lay 480 exposed brick backed up with 610 backing brick per day in this wall, or a total of 1,090 brick per day; and for rougher work in side and rear walls and in unexposed walls each mason will lay 715 exposed brick backed up with 910 backing brick per day, or a total of 1,625 brick per day.

27. This equals 72.7 sq. ft. per day for carefully faced work, and 108.3 sq. ft. per day for rougher work.

28. Laborer's time ⅔ of the bricklayer's time for carefully faced work, and ¾ for rougher work.

Building the 12″ Heavy Duty Wall:

29. This wall is constructed exactly like the standard wall except that the centre and inside withes are built only three courses high.

30. Next place the header course tying these two withes together.

31. This is a continuous course of rowlock headers.

32. The brick in this header course need not have the vertical joints between them filled with mortar. As with the centre withe, see that the bed joints are full, and that the vertical joint is filled to a distance of about one inch from the inside face of the wall.

33. Then the flat header course is placed, consisting of a continuous header course on the outside face with a course of stretchers behind it.

Material and Labor Required, 12″ Heavy Duty Wall:

34. This wall requires 7 exposed brick and 8.8 backing brick per square foot.

35. In walls with the average number of openings and corners, the contractor can safely and conservatively estimate that in front and other walls carefully faced, each mason will lay 480 exposed brick backed up with 603 backing brick per day in this wall, or a total of 1,083 brick per day; and for rougher work in side and rear walls and in unexposed walls each mason will lay 650 exposed brick backed up with 817 backing brick per day, or a total of 1,467 brick per day.

36. This equals 68.5 sq. ft. per day for carefully faced work, and 92.8 sq. ft. per day for rougher work.

37. Laborer's time ⅔ of the bricklayer's time for carefully faced work, and ¾ for rougher work.

Figure 8. Variation of Ideal wall all-rolok effect. Business building in Chicago.

THE ALL-ROLOK WALL

General Description:

38. The all-rolok wall is a general utility wall; and may be employed for exposed and unexposed walls, both bearing and non-bearing, and for basement construction. It forms a perfect base for stucco where a stucco finish is particularly desired; and for plaster where used as an interior wall.

39. The attention of architects and structural engineers is especially drawn to this wall on account of its low cost and light weight, and the opportunity it affords (in common with the rolok-bak wall) for impressive savings in the amount of steel required to support the exterior or interior walls of a skeleton frame building.

40. The wall is built with two courses entirely of stretchers on edge, alternating with one course of flat headers. To the architectural designer it offers opportunities for new and interesting effects.

41. No other form of masonry construction 8″ or more in thickness, can compete with this wall in low cost, not only for exposed walls but also for basement and unexposed walls, such as enclosing walls around stairways, etc.

42. This wall also has the great advantage of exposing to the weather not only a minimum thickness of 2¼″ of solid brick units in its outside withe, but in addition both horizontal and perpendicular exposed mortar joints have the same solid thickness.

43. Because this wall combines the advantages of low labor cost and minimum amount of material for a hollow wall and reduced weight, we predict that it will become increasingly popular. Practical masons know that its flat header courses and continuous stretcher courses are laid very rapidly. The wall may be built 8″ thick and in multiples of 4″ additional thicknesses.

Position of the Header Course:

44. Placing the headers every third course as shown in the illustrations gives an interesting effect to an exposed wall, develops maximum strength, and expedites the construction in cold or wet weather or where an impervious type of brick is used.

45. When light loads only are to be supported, and when a brick with average absorption is used, one or two additional courses on edge may be placed safely between header courses.

Constructing the 8″ Wall:

46. The bricklayer first lays two courses of continuous stretchers to form the outside withe; and then two courses of continuous stretchers to form the inside withe. He then places the flat header course.

Material and Labor required, 8″ Wall

47. This wall requires 9 brick per square foot, of which 6 brick are exposed in outside walls.

48. In walls with the average number of openings and corners, the contractor can safely and conservatively estimate that each mason will lay 1,000 brick per day in front and other walls carefully faced, and 1,150 brick per day for rougher work in side and rear walls and unexposed walls.

49. This equals 111.1 sq. ft. per day for carefully faced work, and 127.7 sq. ft. per day for rougher work.

50. Laborer's time ⅔ of the bricklayer's time for carefully faced work, and ¾ for rougher work.

Constructing the 12″ Wall:

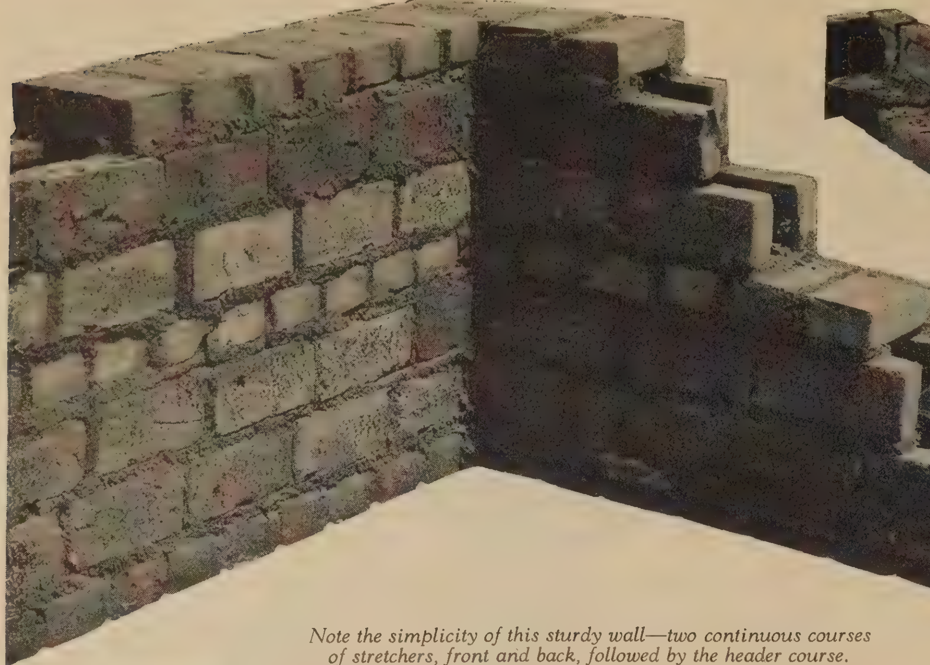
51. The three withes are constructed, each two courses high. The header course consists of pairs of headers laid flat, basket weave bond, with a stretcher placed alternately on the inside and outside of the wall.

52. The centre withe is not placed in the centre of the wall, but at the end of the headers which show on the outside face of the wall. Toward the outside of the wall, therefore, the air space is approximately 3½″ wide, and the air space toward the inside of the wall about 2″ wide.

53. The same suggestions are made as to the building of the centre withe and the placing of the header course as in the case of the 12″ standard rolok-bak wall. (Pars. 22 and 23 of this section).

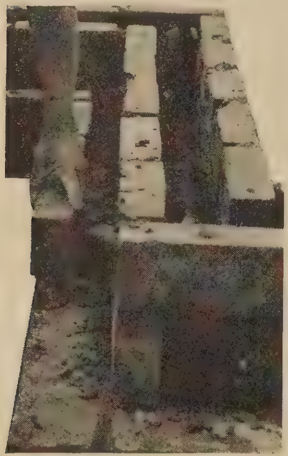
CONSTRUCTION OF THE 8" AND 12" ALL-ROLOK WALL

(*See paragraphs 38 to 57*)



Note the simplicity of this sturdy wall—two continuous courses of stretchers, front and back, followed by the header course.

Starting the 8″ wall on the header.



The centre withe is not centered in the wall, but is lined up at ends of outside headers.

Great strength and simplicity and speed of erection are the characteristics of the 12″ all-rolok wall. Note the beasket-weave header course.

Brick Required per Square Foot:

For 8″ wall—9; for 12″ wall 13.5 of which 6 are exposed.

Weight:

With brick at 4½ lb. each and including mortar, 8″ wall weighs about 51.5 lb. and 12″ wall about 77.25 lb. per square foot.

Cost of Brick per Square Foot:

Take cost of brick per thousand in dollars, call dollars cents, and divide by 10. Result is cost of each brick in cents. Multiply result by number of brick to the square foot as given above.

Examples: Brick at $12 per thousand cost 1.2 cents each; at $20, 2 cents each. Square foot cost of brick is 10.8 cents and 18 cents respectively for 8″ wall; and 16.2 cents and 27 cents respectively for 12″ wall.

Labor Cost:

In walls with usual number corners and openings, safely estimate that a mason will lay, with the 8″ wall, 111.1 sq. ft. per day in carefully faced work. Laborer's time ⅔ mason's. In rougher work 127.7 sq. ft. per day. Laborer's time ¾ mason's.

With 12″ wall, 80 sq. ft. per day in carefully faced wall; laborer's time ⅔ mason's; in rougher work 118.5 sq. ft. per day, laborer's time ¾ mason's.

Figure 9. House of all-rolok construction in Flemish bond at Lansdowne, Pa.

Material and Labor Required, 12″ Wall:

54. This wall requires 13½ brick per square foot, of which 6 brick are exposed per square foot in outside walls.

55. In walls with the average number of openings and corners, the contractor can safely and conservatively estimate that each mason will lay 1,080 brick per day in front and other walls carefully faced, and 1,600 brick per day for rougher work in side and rear walls and unexposed walls.

56. This equals 80 sq. ft. per day for carefully faced work, and 118.5 sq. ft. per day for rougher work.

57. Laborer's time equal to ⅔ of the bricklayer's time for carefully faced work, and ¾ for rougher work.

THE ALL-ROLOK WALL—FLEMISH BOND

General Description:

58. This wall is primarily intended for exposed walls. It is very strong construction, however, and is much used for basement work, and for interior walls.

59. It is constructed entirely of brick on edge laid in Flemish bond for the outside 8″ thickness. For thicker walls a withe of stretchers on edge is added for each additional 4″ thickness.

60. The all-rolok wall previously described in pars. 38 to 57 corresponds roughly to traditional brickwork laid in common bond, and the all-rolok wall in Flemish bond here described corresponds to traditional brickwork in Flemish bond. With Flemish bond, whether flat or on edge, the labor cost is higher than with the simpler bonds such as common bond or the all-rolok wall because the latter can be built more rapidly. The Detriot Bricklayer's Union recently stated, however, that a bricklayer can easily lay 1,000 brick per day with this type of wall 8″ thick. It requires the minimum amount of material.

61. This was the first brick on edge wall to be introduced and promoted some five years ago, and is still mistakenly understood by many to be the only type of Ideal construction.

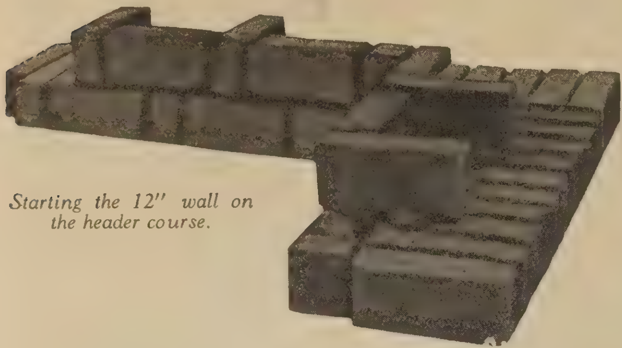
62. Its success has been phenomenal. Homes, churches, schools and industrial buildings have been constructed with this wall.

Appearance:

63. The exposed face of the Flemish bond all-rolok wall has a surprisingly distinctive appearance. Where the rough or wire cut surface of the stretchers is exposed in combination with the smooth end of the headers this produces an effective and charming appearance.

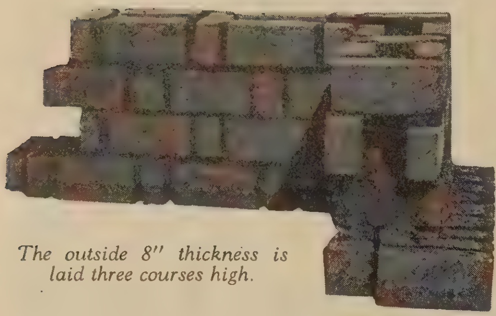
CONSTRUCTION OF THE 8" AND 12" ALL-ROLOK WALL IN FLEMISH BOND

(*See paragraphs 58 to 79*)

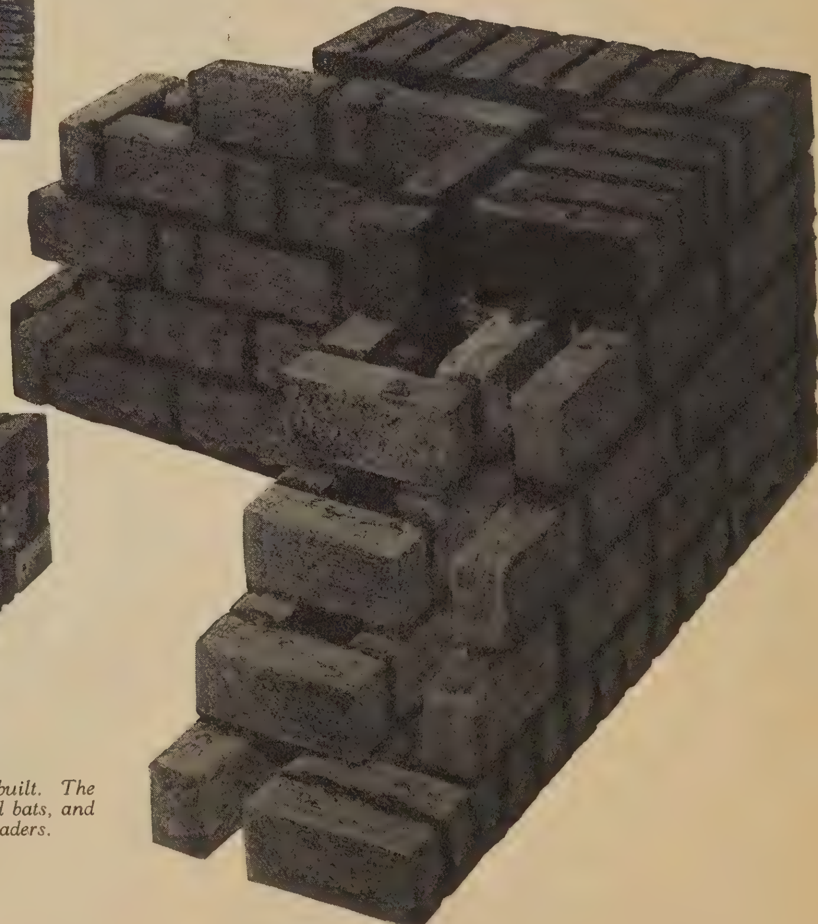


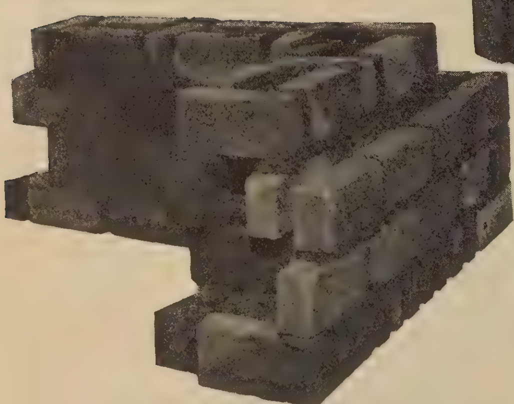
Starting the 12" wall on the header course.

This wall is known throughout the country. Tremendously strong construction entirely of brick on edge.



The outside 8" thickness is laid three courses high.





Three courses entirely of stretchers are then built. The next course of facing consists of stretchers and bats, and the backing a continuous course of rowlock headers.

Brick Required per Square Foot:

For 8" wall, 9; for 12 wall, 13.75; of which 6 are exposed.

Weight:

This wall has approximately the same weight as the all-rolok wall (page 14).

Cost of Brick per Square Foot:

Is approximately the same as for the all-rolok wall, the 12" wall only having ¼ brick additional per sq. ft.

Labor Cost:

In walls with usual number corners and openings, safely estimate that a mason will lay, with the 8" wall, 72.2 sq. ft. per day. Laborer's time ½ mason's.

With the 12" wall, 58.1 sq. ft. per day in carefully faced wall, laborer's time ½ mason's; in rougher work 72.7 sq. ft. per day, laborer's time ½ mason's.

Before passing on the appearance of this wall, lay up half a dozen courses or inspect a sample wall. Whenever judgment is based upon a sample or an actual wall there is no further question as to its beauty.

Figure 10. All-rolok wall in Flemish bond. Building near Baltimore

Building the 8″ Wall:

64. The wall is built by laying headers and stretchers alternately, and backing up at every course.

65. The headers in each course are placed over the centre of the stretchers of the course below.

66. The 8″ thickness of this wall must be laid "pick and dip" fashion and hence is slower to lay than the other types of Ideal wall.

Material and Labor Required, 8″ Wall:

67. In walls with the average number of openings and corners, the contractor can safely and conservatively estimate that each mason will lay 650 brick per day with this wall.

68. This equals 72.2 sq. ft. per day.

69. Laborer's time ½ of the bricklayer's time.

Building the 12″ Wall:

70. The outside 8″ thickness is built as above, three courses high.

71. One course is then placed on the outside withe consisting of stretchers and bats alternately, the bats being used to preserve the bond.

72. The inside withe is then built three courses high entirely of stretchers.

73. A solid header course of brick on edge is then placed to tie the inside withe to the outside 8″ thickness.

74. When building the outside 8″ thickness, a 4″ shelf is left inside on which the mason can store up brick. This partly eliminates the "pick and dip" method which is necessary when the completed wall is to be 8″ thick, and consequently allows the mason to lay more brick per day.

75. The same suggestions are made as to the mortar joints in the solid header course as in the case of the solid header course in the heavy duty rolok-bak wall (par. 32 of this section).

Material and Labor Required, 12″ Wall:

76. This wall requires 13.75 brick per square foot, of which 6 brick are exposed in outside walls.

77. In walls with the average number of corners and openings, the contractor can safely and conservatively estimate that each mason will lay 800 brick per day in front and other walls carefully faced, and 1,000 brick per day for rougher work in side and rear walls and unexposed walls.

78. This equals 58.1 sq. ft. per day for carefully faced work, and 72.7 sq. ft. per day for rougher work.

79. Laborer's time equal to ½ of the bricklayer's time.

GENERAL CONSTRUCTION DATA

Supporting Floors and Roofs:

1. Floor joists and roof construction should rest directly upon a header course. In most cases the header course can be made to come at the exact height required. If not, the header course can simply be brought up as nearly as possible to that height, the remaining height to the bottom of the joists being filled in with the necessary number of courses of solid brickwork to give the joists a firm bearing.

2. Setting the joists upon a header course also provides an effective firestop.

Anchors:

3. While the necessity for using anchors to form a positive tie between floor and roof timbers and the masonry is no greater with the Ideal wall than with any other type of masonry construction, the use of such anchors is emphatically recommended by this Association. It is realized that the practice of using such anchors is more honored in the breach than in the observance; but when some natural calamity such as a tornado visits a community, it has been repeatedly shown that buildings in which anchors and other features of good construction have been conscientiously used come through practically unscathed. Small portions of the Ideal wall in which anchors are to be embedded can easily be made solid. In addition to anchoring floors and roofs, it is recommended that parapet walls be also substantially anchored to the construction.

Earthquake Construction:

4. It should be pointed out that in earthquake zones anchors are vital to the safety of the building. Girders, joists and roof timbers should be anchored securely to the brick walls. Buildings so constructed will withstand earthquake shocks without serious structural damage.

Window and Door Sills and Jambs:

5. Window and door sills (brick on edge or stone) are placed, and the frames set, plumbed and braced upon them in the ordinary way; exactly as with the solid wall.

6. The frames are bricked in at the jambs also, exactly as with the solid wall.

7. Although not necessary for strength, it is recommended that the portion of the hollow space or spaces adjacent to the frame be filled for a width of 3″ or 4″ with brickbats to provide firestopping and draft stopping.

8. Exposed brick may be supported over openings by either of the usual methods of using lintels or arches.

9. For openings not exceeding the usual window or door widths, follow the same method employed in solid brick construction—that of placing 4″ x 4″ or 4″ x 6″ wood lintels to support the backing. The lintels have a 4″ bearing on the brickwork at each end. Brickwork either flat or on edge will arch itself over such an opening even after the wood lintel shrinks or is entirely destroyed by fire.

10. For wider openings the backing may be supported on a steel lintel of proper size to support the load; or a wood lintel may be employed with a relieving arch over. A small portion of the brickwork at the spring line can be made solid to take the thrust, or the arch can spring from a header course. The space between the top of the wood lintel and the bottom of the relieving arch is bricked in with brick on edge; the top of the brickwork being roughly shaped to the proper curve and forming a centre for the relieving arch.

11. It should be emphasized that the foregoing methods are the traditional and ordinary methods of carrying brickwork over openings; and that the Ideal wall introduces nothing new or unusual in this portion of the construction.

12. Mortar should be slushed over the top of wood window and door frames within the hollow space for the same purpose that the space is filled at the jambs — to provide fire and draft stopping.

Window and Door Frames:

13. Stock window and door frames in rolok-bak walls can have the same outside reveal and relation to the inside plaster line as in the case of the ordinary solid wall.

14. In the case of 8″ all-rolok walls, the outside reveal can be made $2\frac{1}{4}$″ wide—the width of a brick on edge. A piece of finish wood is placed between the inside face of the frame and the back of the trim at jamb and head as shown.

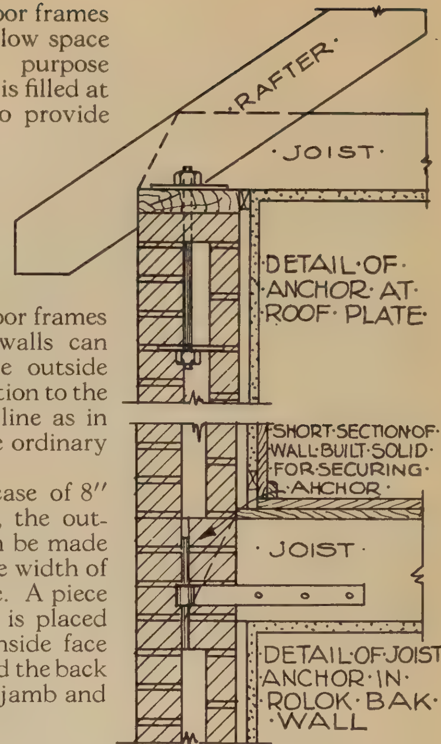


Figure 11. Anchors of any type can be built into Ideal walls and secured by constructing a small part of the wall solid.

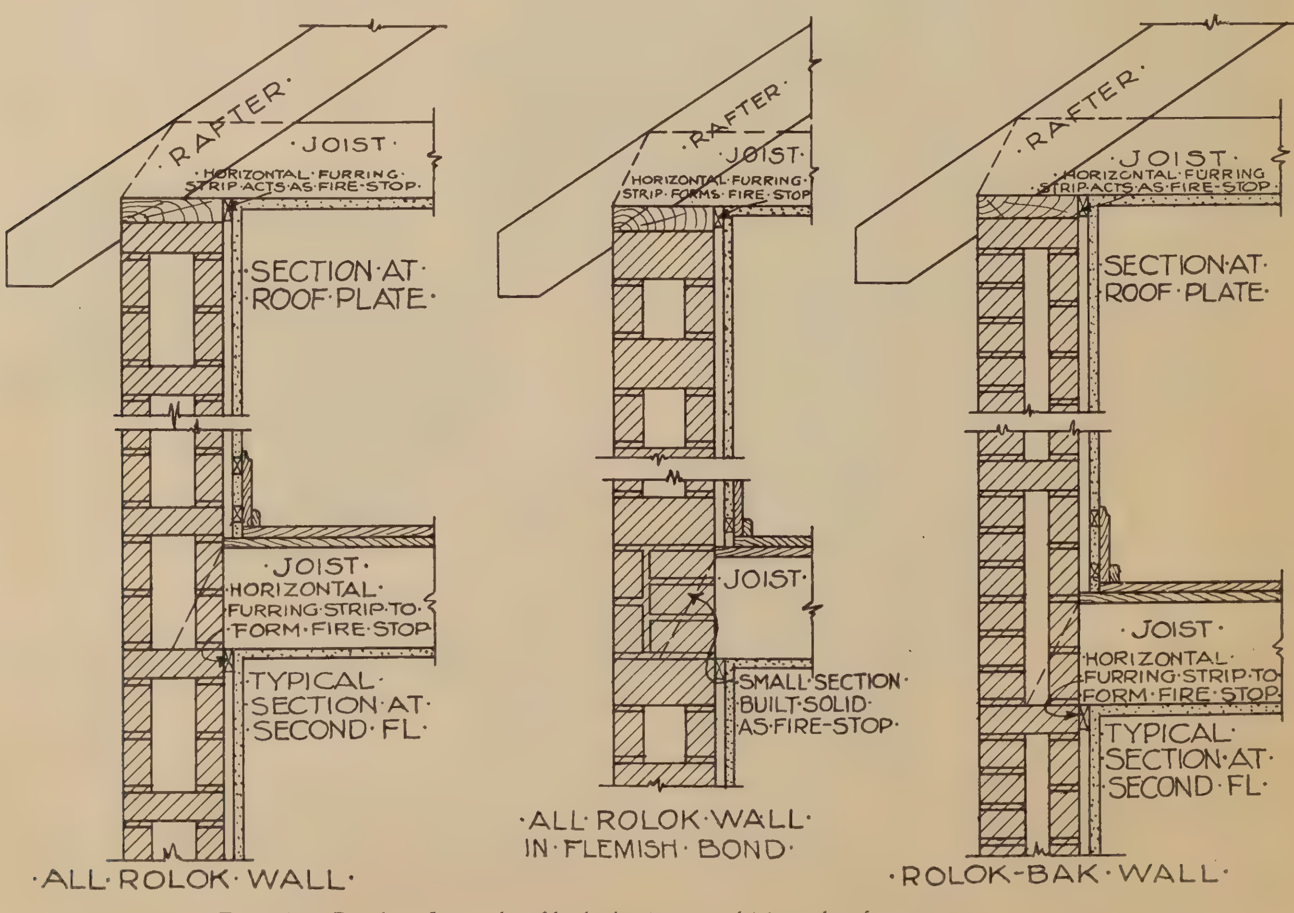
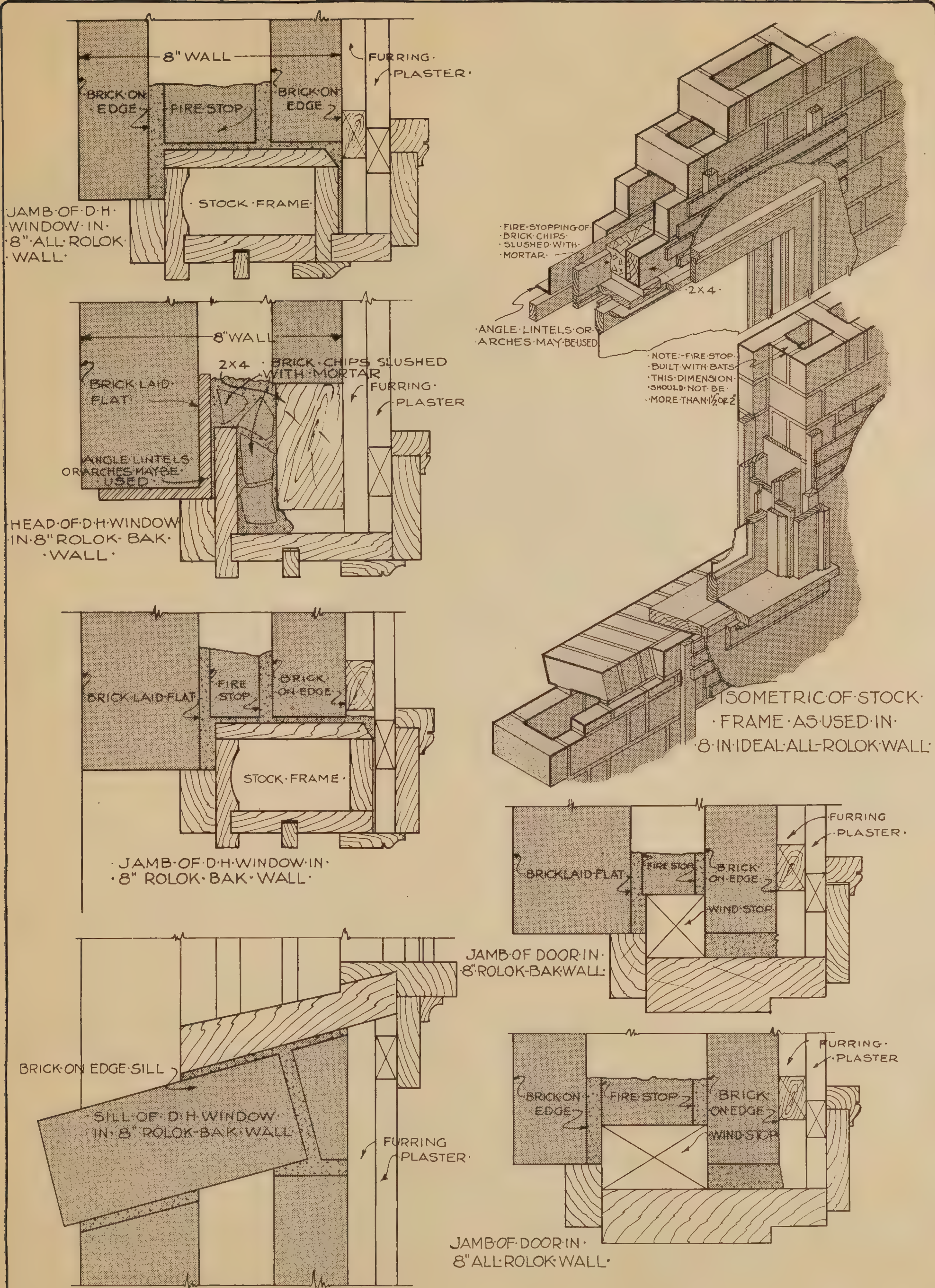


Figure 12. Details at floor and roof levels showing typical joist and roof supports.



DETAILS OF STOCK WINDOW FRAMES AS USED IN 8 IN IDEAL WALLS

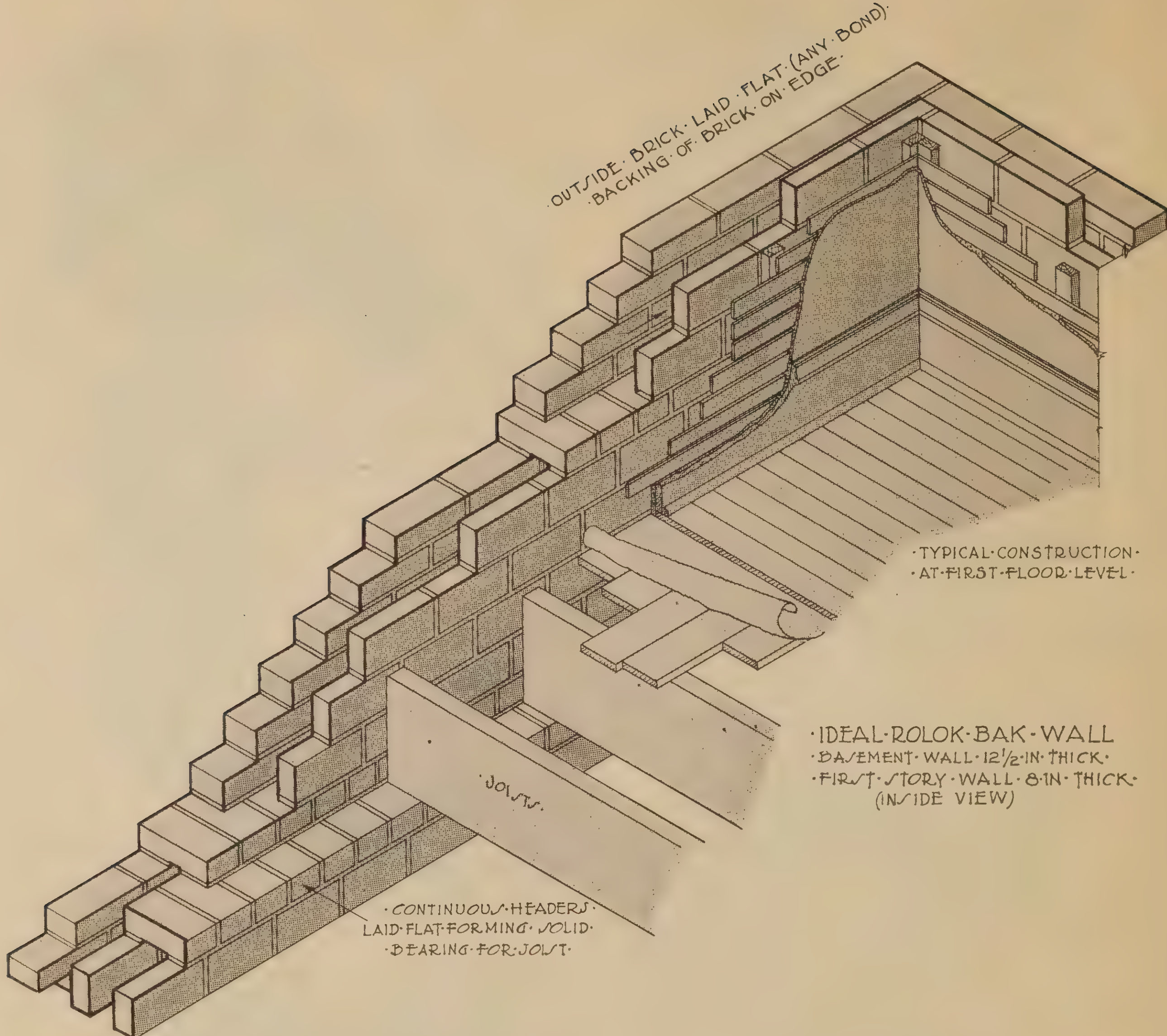


Figure 13. Typical construction detail at first floor level, 8″ rolok-bak wall with 12″ rolok-bak basement wall.

Mortar:

15. It is recommended that mortar of no less strength than 1:1:6 cement-lime mortar be used in constructing Ideal walls.

Joints:

16. Inasmuch as flush cut joints are quite commonly used for exposed walls, it is recommended that these joints be used also for side and rear walls, instead of struck joints. This will increase bricklayer production, and the figures given in this publication can then be increased.

Thickness of Walls:

17. In the absence of code regulation, the following minimum thicknesses are recommended. Basement walls for masonry houses, 12″ thick. First, second and third floor walls for masonry houses, 8″ thick. Basement walls for frame houses, 8″ thick.

WEIGHT, FIRE RESISTIVENESS AND STRENGTH

Weight of Hollow Walls:

1. Ideal walls are lighter per square foot than many types of hollow unit walls, and this is especially true in cases where building codes require thick webs or an extra number of webs in such hollow units. In these cases the Ideal wall saves considerable weight over hollow unit construction. This allows large savings where Ideal walls are used as curtain walls in buildings of skeleton construction.

2. One important element of lightness is the fact that Ideal walls require the minimum amount of mortar per square foot of wall.

Weight per Square Foot of Backing Only of Rolok-Bak Walls:

8″ rolok-bak wall:

4.4 brick (including back of headers) at 4½ lb. . . . . .19.8 lb.
61 cu. in. mortar . . . . 5.3 lb.

Weight of backing only about. . . . . . . .25.1 lb. per sq. ft.

12″ standard rolok-bak wall:

8.9 brick (including back of headers) at 4½ lb. . . . . .40.0 lb.
113 cu. in. mortar. . . .10.0 lb.

Weight of backing only about. . . . . . . .50.0 lb. per sq. ft.

12″ heavy duty rolok-bak wall:

9.7 brick (including back of headers) at 4½ lb. . . . . .43.5 lb.
150 cu. in. mortar . . .13.0 lb.

Weight of backing only about. . . . . . . .56.5 lb. per sq. ft.

NOTE:— The weight of the 4″ brick facing only, including 6⅛ brick at 4½ lb. and 128 cu. in. mortar, totals about 39 lb. per sq. ft.

Weight per Square Foot of All-Rolok Walls:

The weight of all-rolok walls, whether in Flemish or stretcher bond, works out about the same per square foot of wall.

8″ all-rolok wall:

9 brick at 4½ lb. . . . .40.5 lb.
127 cu. in. mortar . . .11.0 lb.

Total weight of wall about. . . . . .51.5 lb. per sq. ft.

12″ all-rolok wall:

13½ brick at 4½ lb.60.75 lb.
190 cu. in. mortar. .16.5 lb.

Total weight of wall about. . . . . .77.25 lb. per sq. ft.

NOTE:—When estimating the weight of hollow unit walls for comparison with the above, and including in the figures the weight of the mortar, and the portion of the header courses in the back of the wall, it will be found that the Ideal wall is lighter than the average wall or back-up construction of hollow units.

Fire Resistance of Ideal Wall Construction:

3. According to a recent issue of the *American Architect*, (from which the following data is compiled) the U. S. Bureau of Standards recently made fire tests upon brick masonry walls, including all-rolok walls in Flemish bond, 8″ and 12″ thick. (The detail of the latter thickness was a variation of the wall shown in this publication).

4. The test panels were 11 feet high—giving a very severe test, for it is seldom that walls of that height are built without the steadying action of intermediate floor construction. In addition, some of the specimens (denoted "Unrestrained") were entirely free-standing, without any lateral support whatever above the frame upon which they stood, except for pilasters at the ends of the 8″ panels, which were 16 feet long.

5. The walls were exposed to the temperatures defined by the standard temperature curve, which reaches 1,700° F. at the end of the first hour; 1,850° F. at two hours, with a uniform rise to 2,150° F. at six hours.

Ideal Wall Fire Test Results

(Compiled from U. S. Bureau of Standards report as published in *The American Architect*)

Test No.	Brick	Restraint	Unexposed Face of Wall: Time at which 482°F† was reached Hrs. Mins.	Unexposed Face of Wall: Temperature at 6 hrs. °F
	8″ WALLS			
4	Western surface clay	unrestrained*	not attained	419°(4 hrs.)
5	do.	restrained	not attained	453°
6	do.	restrained	5:58	484°
11	Eastern surface clay	unrestrained*	4:50	493°(5 hrs.)
16	Shale	unrestrained	5:03	522°
	Average for 8″ walls			486°
	12″ WALL			
12	Eastern surface clay	unrestrained	not attained	172°(5 hrs.)

* Tests less than six hours not included in averages.
† A temperature of 482° F is at or near the ignition point of a number of classes of combustible materials.

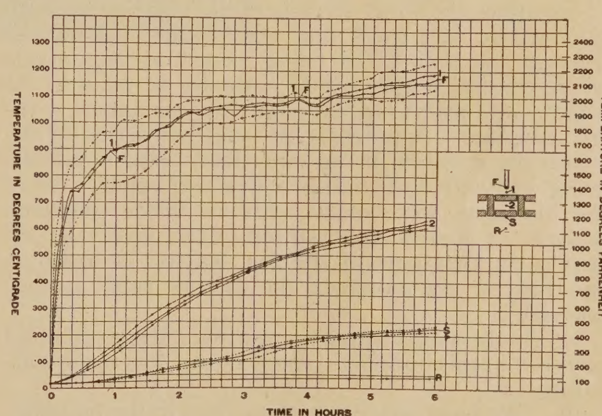


Figure 14. Graphic curves showing heat resistiveness of 8″ Ideal wall during fire tests at U. S. Bureau of Standards. The various curves starting from the left hand lower corner (F and I representing temperatures on furnace side of wall, Q the temperature inside the wall, S the temperature on the enexposed face of the wall and R the room temperature) all rise as the test progresses; the time elapsed being plotted horizontally and the temperature in degrees vertically.

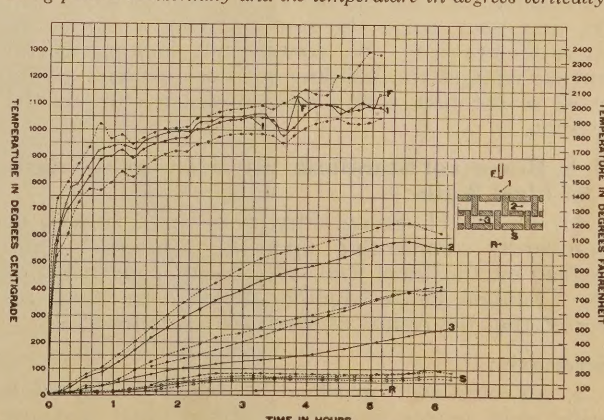


Figure 15. Graphic curves showing heat resistiveness of 12″ Ideal walls during fire tests at U. S. Bureau of Standards

6. The report states in part: "Careful examination of 8-inch and heavier walls after fire test indicated that the header bond provided by . . . . alternate headers and stretchers in the hollow walls was sufficient from the standpoint of resistance to fire to tie the stretcher brick, no general separations occurring."

U. S. Bureau of Standards Builds Ideal Wall Test Structure:

7. An authorized article in a recent issue of *Building Economy* states that the U. S. Bureau of Standards, desiring information on the intensity and duration of fires in various types of buildings, constructed the small building shown in Fig. 16 (about thirty feet by seventeen feet in outside dimensions) in its grounds at Washington, D. C. The walls are of all-rolok construction in Flemish bond, 8″ thick. To date four fire tests have been conducted in this building; and with the exception of the soot around the window openings the brickwork does not appear to an observer to be any the worse for the intense fires that have burned themselves out in its interior.

8. When constructing the building the Bureau desired also to give Ideal construction a practical test to see if difficulties would be encountered in forming window and door openings, pilasters and corner details. "Apparently little trouble was encountered in these respects," according to a statement made by the U. S. Bureau of Standards. The statement continues: "Sometimes the inner stretchers did not line up with the outside stretchers and the header did not go through the wall, a bat being placed on the outside where the full header would normally be placed. At some points we had as many as three stretchers without a header. Apparently this did not seriously decrease the stability of the inner face, these stretchers being tied with full courses above and below. All of the fire tests were made with an inside plastered surface. A considerable portion of the plaster fell off during the first part of the fire, leaving as much as one-third or one-fourth of the interior brick surface exposed."

9. At the time this report was made three tests had been run in this building. Another test was made subsequently.

10. "We have now made three tests in the building, which shows no instability of the walls," continues the statement, "although cracks formed adjacent to the floor and window openings during the test up to three-sixteenths inch wide, which, on cooling, closed up to less than one-eighth inch. The average intensity and duration of each fire did not exceed that incident with the first hour, using the standard time temperature curve for fire tests. We contemplate making several further tests in the building with occupancies giving more severe fires than those introduced up to the present."

U. S. Bureau of Standards Physicist on Strength of Ideal Walls:

11. Dr. A. H. Stang, Physicist, U. S. Bureau of Standards, commenting upon tests made by the Bureau on the Ideal wall, at a recent convention of the Common Brick Manufacturers' Association reported that the results of tests were as follows:—

Strength:

a. All-rolok walls in Flemish bond and solid brick walls eight inches thick have about equal strength under concentric loading; each type of wall being laid either in lime, cement-lime, or cement mortar.

b. When the load is applied with an eccentricity of two inches, the eight inch all-rolok walls in Flemish bond were 24 per cent. stronger than eight inch solid walls when cement-lime mortar was used for both types.

c. Under concentric loading, eight inch walls laid in cement mortar were 24 per cent. stronger than similar walls laid in cement-lime mortar, and 84 per cent. stronger than similar walls laid in lime mortar.

d. One side thrust test was made on one specimen each of the all-rolok wall in Flemish bond and the solid brick wall, both eight inches thick. (The panels were six feet wide and nine feet high). Two large timbers were placed against the side of the wall and jacked against the testing machine. The 8-inch solid wall broke under 6,280 pounds side thrust and under exactly the same conditions the Ideal wall broke when there was a side thrust of 6,520 pounds, a trifle in favor of the Ideal. Since there was one specimen only, I think we can say that the walls were equally strong.

e. About 30 per cent. less material was used for all-rolok Flemish bond walls than for solid brick walls.

f. The time required to lay the test panels of Ideal wall was about the same as for laying the solid brick panels.

Bricklayer Production:

g. 1,100 brick per day was the average bricklayer production when laying all-rolok test walls in Flemish bond in lime mortar, the work being done by contract.

Ideal Walls—Where Allowed and Recommended:

12. The Ideal wall is permitted under the ordinances of many cities. It is impossible to give a complete list of such cities. It is only necessary to say, however, that the Model Building Code of the U. S. Department of Commerce recognizes the Ideal wall; and that such cities as Detroit, Mich.; Cleveland, Ohio; New Haven, Conn.; and other large centres permit the Ideal wall.

13. At a recent meeting of the Building Officials' Conference the following resolution was passed:—

> "Resolved: That the Building Officials Conference in meeting assembled at Louisville, Kentucky, having previously declared that hollow walls of brick, more particularly the type of construction known as the 'Ideal wall' can be safely constructed, believe that such type of brick wall construction should be permitted by building codes within the limitations and under the conditions specified in the report of the Building Code Committee of the U. S. Department of Commerce, entitled, 'Recommended Minimum Requirements for Small Dwelling Construction'."

Suggested Paragraphs for Amendment of Building Codes to Allow Ideal Wall Construction:

14. *a*. Hollow walls constructed with standard solid well burned brick (known as Ideal or hollow walls of brick) as hereafter described may be built wherever walls or piers or back-up construction of hollow tile, concrete block, or other hollow building units are permitted under this ordinance.

b. The provisions of this ordinance governing the minimum thickness and maximum heights of hollow tile, concrete block, or other hollow building unit walls shall apply to Ideal walls.

c. The maximum unit loads which may be placed upon Ideal wall construction shall be the same as the

maximum unit loads which under this ordinance may be placed upon hollow tile or concrete block or other walls of hollow building units.

d. The minimum unit strength requirement for brick for use in Ideal wall construction shall be the same as defined by this ordinance for the minimum unit strength of hollow tile, concrete blocks or other building units; provided that when the minimum unit compressive strength of hollow units is based on their gross area, the minimum compressive strength of brick for Ideal wall construction shall be determined as follows: Take the lowest permitted compressive strength in gross area of any type of hollow unit allowed under this ordinance. Increase this figure by 44%*. The result shall be the minimum compressive strength for brick for use in Ideal wall construction.

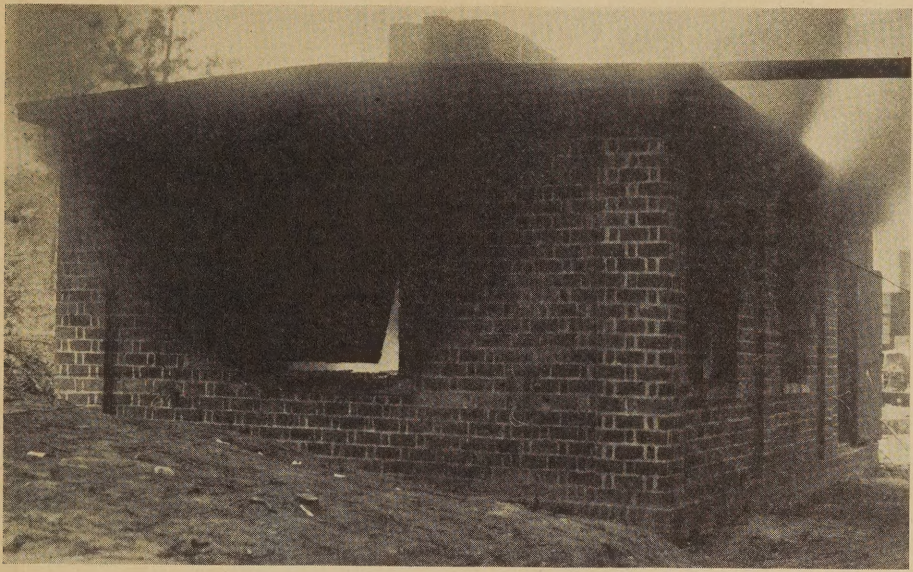


Figure 16. Four intense fires have not harmed this 8-inch Ideal wall test structure at the U. S. Bureau of Standards.

e. Ideal or hollow walls of brick may be laid with some or all of the brick on edge, and such walls shall have at least the following number of continuous vertical thicknesses or withes running in the direction of the wall, and each withe shall have a thickness of at least two and one-quarter inches of solid material, namely:—eight inch walls, two withes; twelve inch walls, three withes; sixteen inch walls, four withes.

**44% is the percentage of non-bearing area to gross area in Ideal wall construction.*

f. There shall not be more than four courses of brick when laid on edge, or more than six courses of brick when laid flat, between header courses; provided that in walls eight inches thick in which each of the two withes is of brick on edge, there shall be not more than three courses of brick on edge between header courses.

g. Header courses in 8″ walls shall consist entirely of headers laid flat or on edge, or may consist of Flemish bond headers.

h. For walls 12 inches in thickness the minimum requirement for the headers in each header course shall be as follows: Two headers shall be placed adjoining each other to tie the facing to the backing. Alongside of and adjoining these headers shall be similarly placed two more headers with faces set in 4″ from the face of the wall to tie the two withes of the backing together. These pairs of headers shall alternate continuously for the full length of the wall.

i. For walls 16″ in thickness the minimum requirement for the headers in each header course shall be as follows: The three withes in the outside 12″ thickness shall be tied together with the minimum number of headers defined in the preceding paragraph (*h*) and the additional withe shall be tied to such 12″ thickness with headers laid in pairs and with a distance of not more than one stretcher between each pair. This arrangement shall be continued for the full length of the wall.

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